ROZMA

T.O. No. 31S1-2FSA10-5

HANDBOOK
INSTALLATION INSTRUCTIONS

TELEVISION CONVERTER-DISPLAY GROUP AN/FSA-10

(WESTINGHOUSE ELECTRIC CORPORATION)

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INTRODUCTION

A. PURPOSE AND SCOPE OF T. O. 31S1-2FSA10-5.

1. This handbook contains the standard instructions for planning, supporting, and accomplishing the installation of the equipment designated herein.

a. Due to the continual discovery of new uses and development of new associated equipments, this handbook does not attempt to detail every possible use of this equipment. It specifies one use and provides data for adaptation to future uses and equipments. For installation with other type equipments refer to the applicable Facility Installation Instructions Handbooks and Standard Facility Equipment Lists (SFEL's).

b. Tune-up and alignment procedures are normally provided in the appropriate Service Instructions Technical Orders. To avoid repetition, this manual will contain only such additional instructions necessary for *initial* installations.

B. PURPOSE AND SCOPE OF SECTIONS.

1. This Technical Order is divided into four functional sections to provide segregated information as follows:

a. Section I supplies information so that an organization having a C-E requirement can *determine:*

(1) Will this equipment fulfill the requirement (or a part of the requirement) under consideration.

(2) The advantages and disadvantages of the equipment for comparison to similar equipments.

b. Section II assists personnel, planning to use or install this shipment, to consider all necessary factors and take all necessary action to provide for a *complete* installation (adequate power, real estate, supporting structures, etc.).

c. Section III contains adequate information so that qualified engineers (usually the installation-engineering agency) can adapt the equipment to new uses, new related equipment, and new layouts as required.

d. Section IV provides definitive plans for the installation of the equipment for use in the manner for which the equipment is designed.

2. Due to the natural overlap between the foregoing functions, cross-reference between sections is required to prevent excessive duplication. Complete information to fulfill each section's purpose is supplied or adequately referenced.

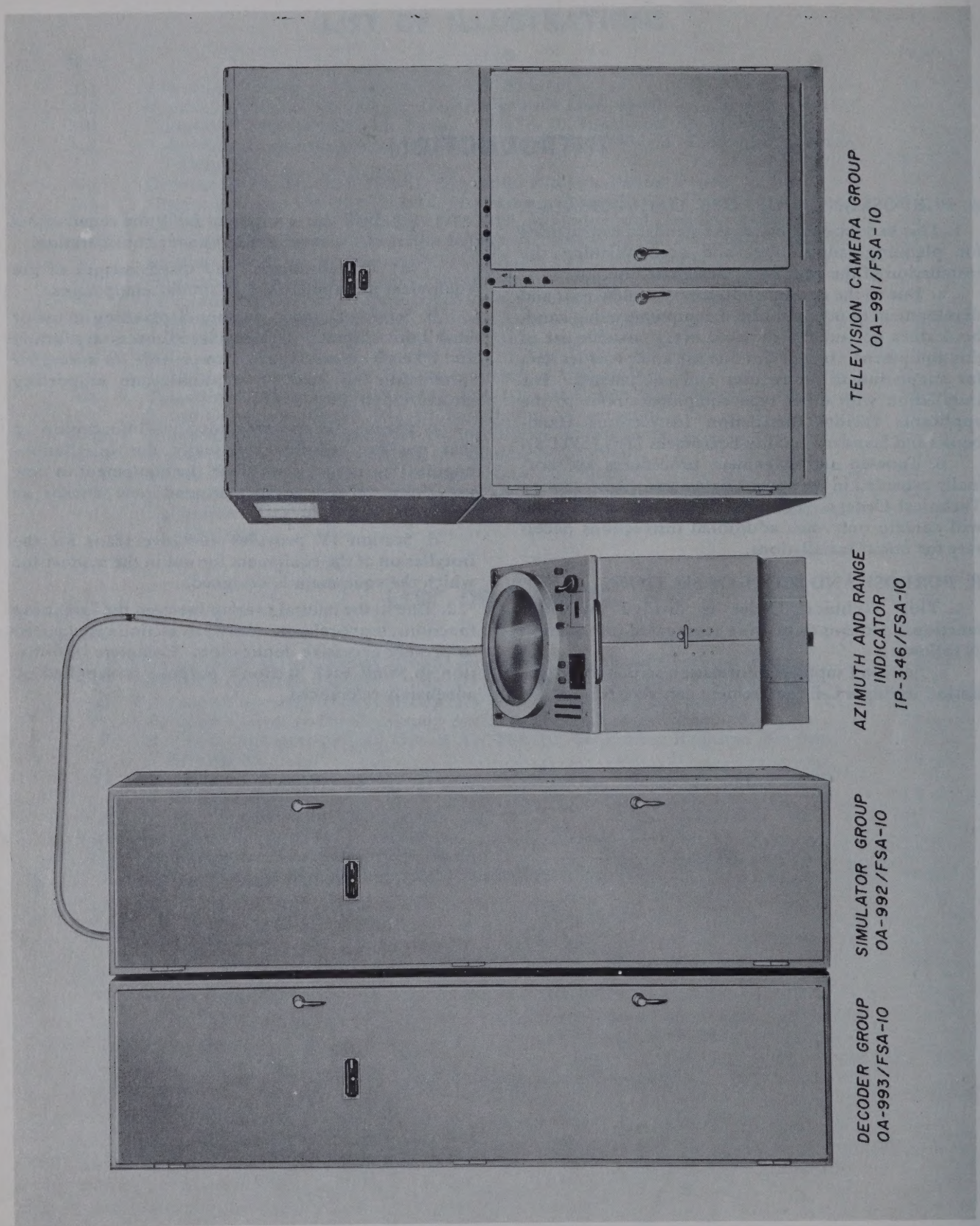


Figure 1-1. Television Converter-Display Group AN/FSA-10

SECTION I

GENERAL DESCRIPTION

1-1. PURPOSE OF TELEVISION CONVERTER-DISPLAY GROUP AN/FSA-10.

1-2. Television Converter-Display Group AN/FSA-10, shown in figure 1-1, is a video combination equipment that combines the displays of as many as six low-altitude search radar sets. These radar sets are remotely located, in relation to a central radar set, at points at which gaps appear in the low-altitude coverage of the central radar set. The gaps are caused by irregularities in the surrounding terrain. In combining the displays, Television Converter-Display Group AN/FSA-10 transforms the coordinates of the remote video information so that all of the displays are displaced with respect to the central-radar location. The properly oriented remote video is applied to appropriate indicators at the central-radar site. The indicators (not a part of Television Converter-Display Group AN/FSA-10) also receive video information in the conventional manner from the central radar. A selection is afforded at the indicators so that the combined remote-radar video may be displayed with the central-radar video. Thus, high and low altitude coverage is provided by filling the gaps in the central-radar coverage. A special precision indicator is provided with Television Converter-Display Group AN/FSA-10 for use only in maintenance and system calibration.

1-3. GENERAL DESCRIPTION OF TELEVISION CONVERTER-DISPLAY GROUP AN/FSA-10.

1-4. All of the components of Television Converter-Display Group AN/FSA-10 except Azimuth and Range Indicator IP-346/FSA-10 are mounted in stationary cabinets which make up the following major units:

Name	*AN Type No.*	*Quantity*
Decoder Group	OA-993/FSA-10	1*
Simulator Group	OA-992/FSA-10	1
Television Camera Group	OA-991/FSA-10	1
Azimuth and Range Indicator	IP-346/FSA-10	1

*The basic Television Converter-Display Group AN/FSA-10 includes one Decoder Group OA-993/FSA-10. Decoder Group OA-993 FSA-10 provides two channels for the conversion of signals received from two remote radar sets. An additional one or two Decoder Groups OA-993 FSA-10 are required at an installation where more than two remote radar sets are used.

Figure 1-1 shows the components which comprise the basic Television Converter-Display Group AN/FSA-10. Decoder Group OA-993/FSA-10 and Simulator Group OA-992/FSA-10 consist of all metal cabinets which contain rack-mounted chassis. Chassis are interconnected by cables which connect to chassis fanning strips. External connections are made by means of cable entry ports at the bottom of the cabinets except for the connection from Simulator Group OA-992/FSA-10 to Azimuth and Range Indicator IP-346/FSA-10. This connection is made by means of a cable and boom assembly as shown in figure 1-1. Television Camera Group OA-991/FSA-10 consists of an all metal cabinet which is divided into two sections. The upper section contains a television camera and six three-inch PPI displays all mounted on Television Camera Support MT-1612/FSA-10. The lower section contains rack-mounted chassis. Chassis interconnections are made by means of fanning strips located in the cabinet. Connections to Television Camera Support MT-1612/FSA-10 are made by means of unit connectors. External connections are made by means of cable connections located at the bottom of the cabinet. Azimuth and Range Indicator IP-346/FSA-10 is a small indicator console that is mounted on wheels to allow convenient location during maintenance or calibration of the system. The PPI display is mounted on a slanting panel to facilitate observation. The interconnection cable and boom assembly facilitates moving the unit about during maintenance.

1-5. FUNCTIONAL DESCRIPTION OF TELEVISION CONVERTER-DISPLAY GROUP AN/FSA-10.

1-6. As stated previously, Television Converter-Display Group AN/FSA-10 combines the displays of as many as six remote radar sets. The combination is made in such a manner that gaps are filled in the coverage of a centrally-located radar set thus providing a complete central-radar presentation. Television Converter-Display Group AN/FSA-10 is located at the central-radar site. If the central radar has a 100-mile range of operation, the remote radar sets are located within a 100-mile radius of the central radar. If the central radar operating range is 150 miles, the remote radar sets are located within 125 miles of the central radar.

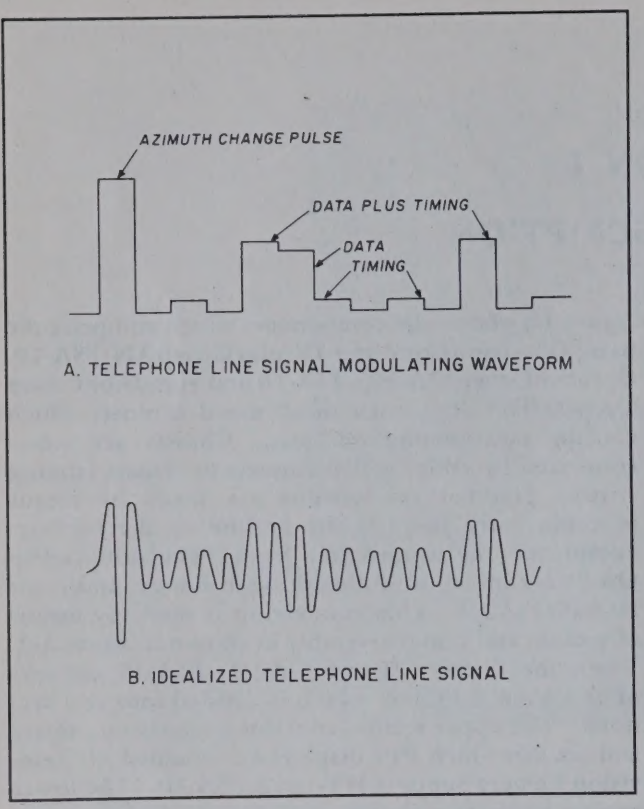


Figure 1-2. Modulating Waveform and Idealized Telephone Line Signal

1-7. The four basic units of Television Converter-Display Group AN/FSA-10 are Decoder Group OA-993/FSA-10, Television Camera Group OA-991/FSA-10, Simulator Group OA-992/FSA-10 and Azimuth and Range Indicator IP-346/FSA-10. Decoder Group OA-993/FSA-10 provides two channels for the conversion of telephone-line signals (received from two remotely-located radars) to signals that are used to produce two three-inch PPI-type presentations that duplicate the remote-radar presentations. The PPI tubes are located in Television Camera Group OA-991/FSA-10. Six three-inch PPI tubes are provided thereby making it possible to display the video from six remote radar sets (if additional Decoder Group(s) OA-993/FSA-10 are employed). In Television Camera Group OA-991/FSA-10 the PPI tubes are arranged within a circle, the center of which represents the center of the central-radar coverage. A television camera then views the array of three-inch PPI displays and converts the optical image of the presentations of the three-inch PPI tubes to an equivalent electrical storage pattern image. This image is converted to sequential video-frame signals by a radially scanned electron read-out beam. Each successive frame of video is synchronized in time with the main bang of the central radar, and in azimuth with the instantaneous position of the moving central-radar antenna. With this synchronization, camera image video may be mixed directly with the central-radar video to form one composite display. Such a display is provided on Azimuth and Range Indicator IP-346/FSA-10. The PPI sweep of Azimuth and Range Indicator IP-346/FSA-10 is synchronized in azimuth with the central-radar sweep. In addition, range and angle marks are displayed. The PPI presentation of Azimuth and Range Indicator IP-346/FSA-10 is used only for adjusting the units of Television Converter-Display Group AN/FSA-10. Radar Signal Simulator SM-86/FSA-10 produces a signal with the same characteristics as the signal received on the telephone line. When selected, the output of Radar Signal Simulator SM-86/FSA-10 can be applied simultaneously to each Video Decoder KY-188/FSA-10 in place of the telephone line signal. By utilizing the simulated signals, any channel of Television Converter-Display Group AN/FSA-10 may be checked for proper operation without an input from a remote radar set.

1-8. A functional block diagram of Television Converter-Display Group AN/FSA-10 is shown in figure 1-3 at the end of this section. The input telephone-line signal from the remote radar is connected to the Signal Selector in Simulator Group OA-993/FSA-10. The incoming telephone-line signal is shown in figure 1-2. The signal consists of a 2000-cps carrier that is amplitude modulated with azimuth change pulses, north mark pulses, timing pulses and data pulses. The azimuth change pulses, which occur every 1.4 degrees of rotation of the remote-radar antenna, are generated by a mechanical device located in the remote-radar antenna pedestal. The nominal rate of rotation of the antenna is 5.33 rpm. Thus, the azimuth change pulses occur approximately every 44 milliseconds. The north mark pulses occur when the remote-radar antenna is pointing true north. These pulses, which occur in the interval immediately following an azimuth change pulse, have the same amplitude as the azimuth change pulse as shown in figure 1-2. The data pulses are generated when a target is detected by the remote radar. On the modulating waveform the data pulse amplitude is one-half the azimuth change pulse amplitude. The timing pulses, occurring at the rate of 800 cps, are used to recover the azimuth change pulses, north mark pulses and data pulses in the proper time relationship corresponding to the remote-radar output. On the modulating waveform the timing pulse amplitude is one-tenth of the azimuth change pulse amplitude as shown in A of figure 1-2.

1-9. The telephone-line signal that is fed to the Signal Selector in Simulator Group OA-992/FSA-10 is distributed by the Signal Selector to the appropriate Video Decoder KY-188/FSA-10. In Video Decoder KY-188/FSA-10 the signal is amplified and demodulated. The demodulated signal is then fed to two trigger slicers which are set to select and to separate, by amplitude discrimination, the azimuth change and north mark pulses from the data pulses. In addition,

sharp narrow timing pulses (1600 pps) are produced from the demodulated signal. Thus, azimuth change pulses, north mark pulses, data pulses and timing pulses are the outputs produced by Video Decoder KY-188/FSA-10 as shown in figure 1-3.

1-10. Video Decoder KY-188/FSA-10 supplies azimuth change pulses and north mark pulses to Electrical Synchronizer SN-166/FSA-10. In this component a motor rotates at azimuth change pulse rate. Shaft rotation at north mark rate is obtained through a 256:1 reduction gear. Sweep voltage for a three-inch PPI tube is generated in Sweep Generator SG-132/FSA-10 and applied to a resolver driver coil in Electrical Synchronizer SN-166/FSA-10. The resolver rotor, which is driven on the output shaft of the reduction gear, produces the resolved sweep voltages for a three-inch PPI. The resolved sweep voltages, when applied to the deflection plates of a three-inch PPI tube, produce a PPI sweep that is synchronized in azimuth with the associated remote-radar antenna. North-south and east-west sweep voltages produced in the resolver in Electrical Synchronizer SN-166/FSA-10 are applied to Sweep Generator SG-132/FSA-10 where they are amplified and fed to Indicator Control C-1780/FSA-10.

1-11. The inputs to Sweep Generator SG-132/FSA-10 are azimuth change, data, timing and north mark pulses as shown in figure 1-3. The azimuth change pulses trigger a sweep circuit which generates the sweep voltage for a three-inch PPI tube. The data pulses are shaped and fed to Indicator Control C-1780/FSA-10 as remote-radar video. The timing pulses are divided down to range-mark pulses occurring at three-mile intervals. When selected by the operator, the three-mile range marks are gated by the north mark and displayed on the three-inch PPI tube. This display affords the operator a check on the orientation of the associated remote-radar video since the range marks are displayed only when the remote-radar antenna is pointing exactly north.

1-12. Indicator Control C-1780/FSA-10 receives blanking pulse, remote-radar video, north-south sweep and east-west sweep inputs as shown in figure 1-3. Indicator Control C-1780/FSA-10 contains the controls and circuits which provide the display signals for two associated three-inch PPI tubes.

1-13. The PPI displays are viewed by Television Camera PH-710/FSA-10. The readout beam of Television Camera PH-710/FSA-10 is synchronized with the central-radar sweep. Input central-radar sweep data is applied to Electronic Control Amplifier AM-1357/FSA-10 which then couples the data to Sweep Generator SG-131/FSA-10. A central-radar trigger is applied directly to Sweep Generator SG-131/FSA-10. The central-radar trigger is divided down to a lower repetition rate which is suitable for triggering the camera sweep generator circuits. The sweep generator circuits produce the currents for the deflection coils of the camera tube in Television Camera PH-710/FSA-10.

1-14. Television Camera Control C-1781/FSA-10 contains the controls used for adjusting the television camera sweep. Television Camera Support MT-1612/FSA-10 supports two PPI clusters (three three-inch PPI's per cluster) and their mounts, a mirror, and Television Camera PH-710/FSA-10 as shown in figure 1-3. In Television Camera PH-710/FSA-10 an electron beam is radially scanned across a photoconductive target upon which the optical image of each remote-radar PPI display is focused. Bright spots in the image on the target, when scanned, produce negative video signals at the output of the camera tube. Each successive radial sweep "reads out" the image and produces a frame of remote-radar video. After two stages of amplification the remote-radar video signal is applied to Video Amplifier AM-1356/FSA-10. The remote-radar video signal is passed through a differentiation circuit in Video Amplifier AM-1356/FSA-10 to remove noise. The final stage of Video Amplifier AM-1356/FSA-10 is a mixer in which central-radar video and remote-radar video are mixed and fed to Azimuth and Range Indicator IP-346/FSA-10. In Azimuth and Range Indicator IP-346/FSA-10 a composite presentation is displayed on a 16-inch PPI. Remote-radar video is sent from Video Amplifier AM-1356/FSA-10 to the central-radar indicators which have been modified to operate in conjunction with Television Converter-Display Group AN/FSA-10. At these indicators the remote-radar video may be displayed on the central-radar presentation.

1-15. EQUIPMENT DATA.

1-16. Table I lists the functional characteristics of Television Converter-Display Group AN/FSA-10.

TABLE I

TELEVISION CONVERTER-DISPLAY GROUP AN/FSA-10, FUNCTIONAL CHARACTERISTICS

CHARACTERISTIC	DESCRIPTION
a. TEMPERATURE LIMITATIONS.	1. Operating Temperature: 0 to 35° C (32 to 95° F)

TABLE I—Continued

CHARACTERISTIC	DESCRIPTION
a. TEMPERATURE LIMITATIONS. (Continued)	2. Ambient Temperatures: (a) Operating: *Nominal* — *Extremes* 20° C (68° F) — 0° to 35° C (32 to 95° F) ±10° C (+86°, +50° F) (b) Non-operating: −54° to +71° C (−67 to +158° F)
b. CAPABILITIES.	1. Television Converter-Display Group AN/FSA-10 is capable of operating in conjunction with a central radar and as many as six geographically dispersed remote radars (if extra Decoder Groups OA-993/FSA-10 are used). 2. Television Converter-Display Group AN/FSA-10 can be set up for two ranges of operation; 100 nautical miles or 150 nautical miles depending on the requirements of the installation site. 3. Remote radar sets may be located anywhere up to 100 nautical miles from the central-radar site for the 100-mile range of operation and anywhere up to 125 nautical miles from the central-radar site for the 150-mile range of operation. 4. After at least a two-hour system warmup period, the initial positioning of the three-inch PPI's is accurate to within ±1.5 nautical miles of the coordinates representing the geographic location of the associated remote radars. 5. The three-inch PPI display will not drift over ±2.0 miles, from the initial position in an eight-hour period. 6. Television Converter-Display Group AN/FSA-10 is capable of producing an output display such that targets separated by as little as 1.5 nautical miles are shown as separate and distinct targets.
c. OPERATING LIMITATIONS.	1. Television Converter-Display Group AN/FSA-10 is capable of operation up to approximately 8,000 feet above sea level. 2. Television Converter-Display Group AN/FSA-10 may be transported in a non-operating condition up to approximately 30,000 feet above sea level. 3. The three-inch PPI cluster arrangement in Television Camera Group OA-991/FSA-10 is a limiting factor when considering the siting of the remote radar sets. If two remote radar sets are located less than 125 nautical miles from each other, their associated three-inch PPI tubes must be in different clusters. If the edges of two three-inch PPI tubes in the same cluster are tangent, the range from center-to-center of the tubes is 125 nautical miles. It can be seen then that this is the shortest range at which two remote radar sets may be located from each other in order to be represented on the same PPI cluster. In some cases all three PPI tubes in a cluster cannot be set for 125 miles between centers due to positioning arm hardware or anode cap interference.

TABLE I—Continued

CHARACTERISTIC	DESCRIPTION
d. DUTY.	The duty of Television-Converter-Display Group AN/FSA-10 is continuous except for maintenance periods.
e. SIGNAL INPUT REQUIREMENTS.	1. Television Converter-Display Group AN/FSA-10 can display signals from one to six remote radar sets depending upon the number of Decoder Group(s) OA-993/FSA-10 used and the number of channels employed in each system. The idealized telephone-line signal input, for each channel, to Television Converter-Display Group AN/FSA-10 is shown in B of figure 1-2. 2. The modulating waveform shown in figure 1-2A consists of the following pulses: (a) A synchronization pulse (azimuth change pulse). Azimuth change pulse peak-to-peak amplitude may vary from 0.05 to 0.5 volts at the input to Video Decoder KY-188/FSA-10. (b) A position synchronization pulse (north mark). This pulse (not shown in figure 1-2) occurs in the time interval immediately following every 256th azimuth change pulse. North mark has the same amplitude as azimuth change pulse amplitude. (c) A timing pulse with a relative amplitude of 0.1 azimuth change pulse amplitude. (d) A data pulse with a relative amplitude of 0.5 azimuth change pulse amplitude. 3. Carrier Frequency: The carrier frequency of the input telephone-line signal is 2000 cps. The unmodulated residual carrier in the telephone-line signal has a relative amplitude of one-fourth of the azimuth change pulse amplitude. 4. Central-Radar Trigger Requirements: Television Converter-Display Group AN/FSA-10 requires a positive radar trigger from the central radar set. This radar trigger should have an amplitude of 25 to 55 volts, a duration of one to six microseconds and a repetition rate of 200 to 400 pps. 5. Central-Radar Antenna Azimuth Synchronization: Television Converter-Display Group AN/FSA-10 operates in conjunction with any central radar which has antenna speeds within the range of 3.0 to 7.0 rpm and which transmits positions at 1:1 and 1:36 speeds. 6. Central Radar Video: The central-radar video input to Television Converter-Display Group AN/FSA-10 should have a peak amplitude of 1.5 to 2.5 volts, a pulse length of two to six microseconds, and a two-megacycle bandwidth.

TABLE I—Concluded

CHARACTERISTIC	DESCRIPTION
f. SIGNAL OUTPUTS FROM TELEVISION CONVERTER-DISPLAY GROUP AN/FSA-10.	1. The peak amplitude of the video signals supplied to the central-radar system ranges from 1.2 to 2.5 volts. 2. The output can be set up for two ranges of operation; 100 nautical miles or 150 nautical miles depending on the requirements of the installation site. 3. The remote-video output from Television Converter-Display Group AN/FSA-10 is supplied to the central-radar system by one video line (50 to 75 ohms). 4. For synchronized operation the remote-video output from Television Converter-Display Group AN/FSA-10 is accurate within ± 0.7 degree of the remote-radar antenna position. 5. Radar Signal Simulator SM-86/FSA-10 provides a signal which simulates the output of Coordinate Data Transmitting Set AN/FST-1. This signal is used for system test and calibration.
g. TELEPHONE LINE REQUIREMENT.	1. Commercial data-grade telephone line, should be used to supply the input signal to Television Converter-Display Group AN/FSA-10. The telephone line and associated equipment should meet the following requirements: (a) Gain fluctuations should be gradual over a one day period. (b) Transients should be absent. (c) No a-c interference should be present. (d) A compressor or expandor should not be used. (e) The telephone line signal should not be intermittent or fail completely.

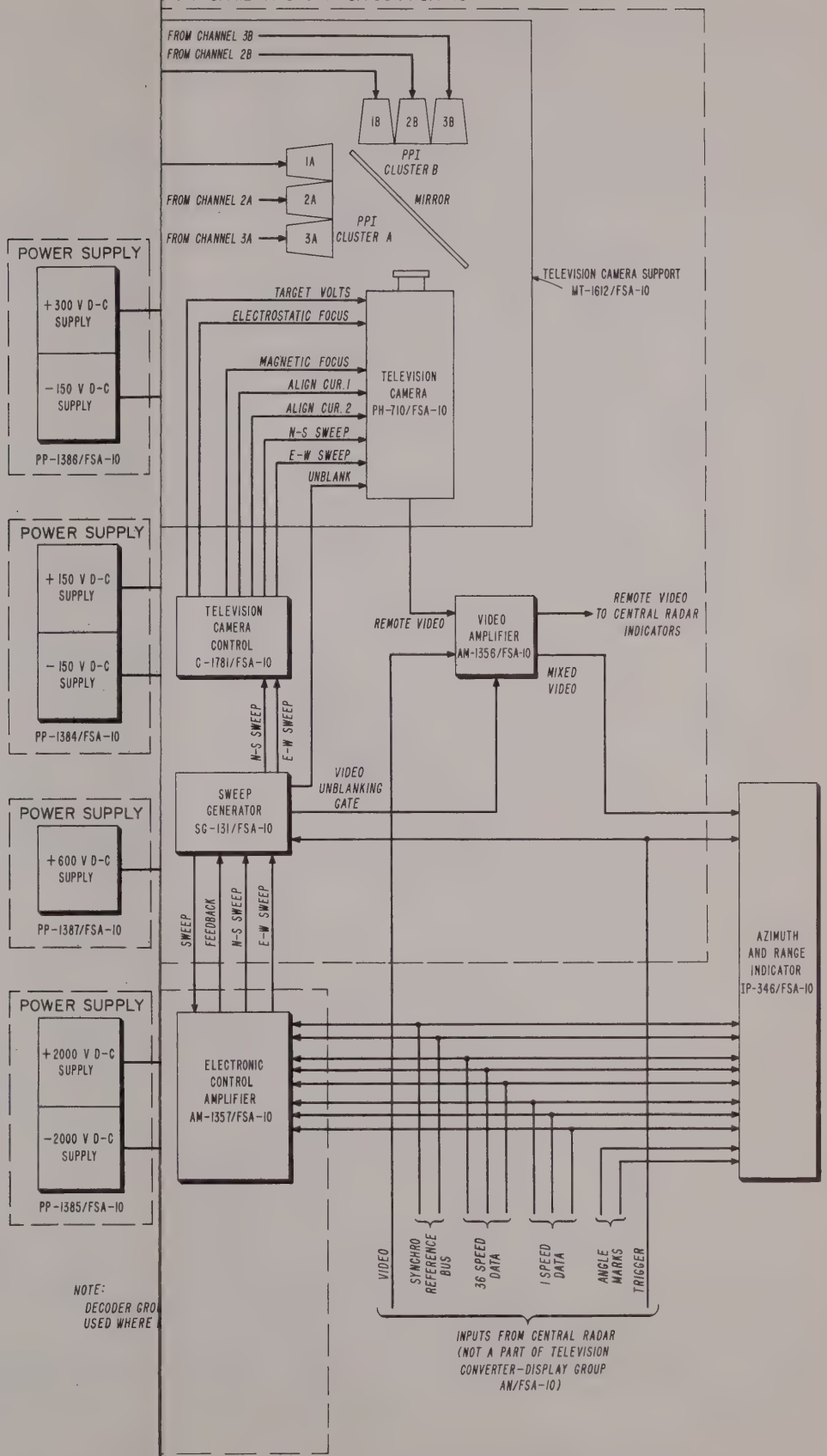
1-17. RELATIONSHIP TO EXISTING EQUIPMENTS.

1-18. Television Converter-Display Group AN/FSA-10 receives its input signals by way of single-pair, 600-ohm telephone lines (or other suitable communication equipment) from a Coordinate Data Transmitting Set AN/FST-1 that is located at the remote-radar site. Radar Set(s) AN/FPS-14 or AN/FPS-18, located at the remote site, produce the video which is converted to signals suitable for transmission on telephone lines by Coordinate Data Transmitting Set AN/FST-1. The remote radar sets are specially designed to perform their function. Thus, the choice of remote radar sets to operate with Television Converter-Display Group AN/FSA-10 is limited to Radar Sets AN/FPS-14 or AN/FPS-18.

1-19. The choice of central radar sets to operate with Television Converter-Display Group AN/FSA-10 is quite flexible. Radar Sets AN/FPS-3 (or its mobile version AN/MPS-7), AN/FPS-7, AN/FPS-8 (or its mobile version AN/MPS-11), AN/FPS-10, AN/FPS-20 or AN/CPS-6B may be used as central radar sets. At the central-radar site, the central radar supplies radar trigger, video, angle marks and synchro data to Television Converter-Display Group AN/FSA-10. The remote-video output from Television Converter-Display Group AN/FSA-10 is fed to the central-radar indicators. The central-radar indicators must be modified to operate in conjunction with Television Converter-Display Group AN/FSA-10.

1-20. Control Monitor Set AN/FSW-1 is designed to provide control of certain functions of the remote-radar equipment from the central-radar site. In addition, certain functions at the remote-radar site are transmitted for monitoring only. One Control Monitor Set AN/FSW-1 is required for each remote radar set, and one telephone line is required for each Control Monitor Set AN/FSW-1. Control Monitor Set AN/FSW-1 is not interconnected to Television Converter-Display Group AN/FSA-10.

SION CAMERA GROUP OA-991/FSA-10



r-Display Group AN/FSA-10, Functional Block Diagram

TABLE I—Concluded

CHARACTERISTIC	DESCRIPTION
f. SIGNAL OUTPUTS FROM TELEVISION CONVERTER-DISPLAY GROUP AN/FSA-10.	1. The peak amplitude of the video signals supplied to the central-radar system ranges from 1.2 to 2.5 volts. 2. The output can be set up for two ranges of operation; 100 nautical miles or 150 nautical miles depending on the requirements of the installation site. 3. The remote-video output from Television Converter-Display Group AN/FSA-10 is supplied to the central-radar system by one video line (50 to 75 ohms). 4. For synchronized operation the remote-video output from Television Converter-Display Group AN/FSA-10 is accurate within ±0.7 degree of the remote-radar antenna position. 5. Radar Signal Simulator SM-86/FSA-10 provides a signal which simulates the output of Coordinate Data Transmitting Set AN/FST-1. This signal is used for system test and calibration.
g. TELEPHONE LINE REQUIREMENT.	1. Commercial data-grade telephone line, should be used to supply the input signal to Television Converter-Display Group AN/FSA-10. The telephone line and associated equipment should meet the following requirements: (a) Gain fluctuations should be gradual over a one day period. (b) Transients should be absent. (c) No a-c interference should be present. (d) A compressor or expandor should not be used. (e) The telephone line signal should not be intermittent or fail completely.

1-17. RELATIONSHIP TO EXISTING EQUIPMENTS.

1-18. Television Converter-Display Group AN/FSA-10 receives its input signals by way of single-pair, 600-ohm telephone lines (or other suitable communication equipment) from a Coordinate Data Transmitting Set AN/FST-1 that is located at the remote-radar site. Radar Set(s) AN/FPS-14 or AN/FPS-18, located at the remote site, produce the video which is converted to signals suitable for transmission on telephone lines by Coordinate Data Transmitting Set AN/FST-1. The remote radar sets are specially designed to perform their function. Thus, the choice of remote radar sets to operate with Television Converter-Display Group AN/FSA-10 is limited to Radar Sets AN/FPS-14 or AN/FPS-18.

1-19. The choice of central radar sets to operate with Television Converter-Display Group AN/FSA-10 is quite flexible. Radar Sets AN/FPS-3 (or its mobile version AN/MPS-7), AN/FPS-7, AN/FPS-8 (or its mobile version AN/MPS-11), AN/FPS-10, AN/FPS-20 or AN/CPS-6B may be used as central radar sets. At the central-radar site, the central radar supplies radar trigger, video, angle marks and synchro data to Television Converter-Display Group AN/FSA-10. The remote-video output from Television Converter-Display Group AN/FSA-10 is fed to the central-radar indicators. The central-radar indicators must be modified to operate in conjunction with Television Converter-Display Group AN/FSA-10.

1-20. Control Monitor Set AN/FSW-1 is designed to provide control of certain functions of the remote-radar equipment from the central-radar site. In addition, certain functions at the remote-radar site are transmitted for monitoring only. One Control Monitor Set AN/FSW-1 is required for each remote radar set, and one telephone line is required for each Control Monitor Set AN/FSW-1. Control Monitor Set AN/FSW-1 is not interconnected to Television Converter-Display Group AN/FSA-10.

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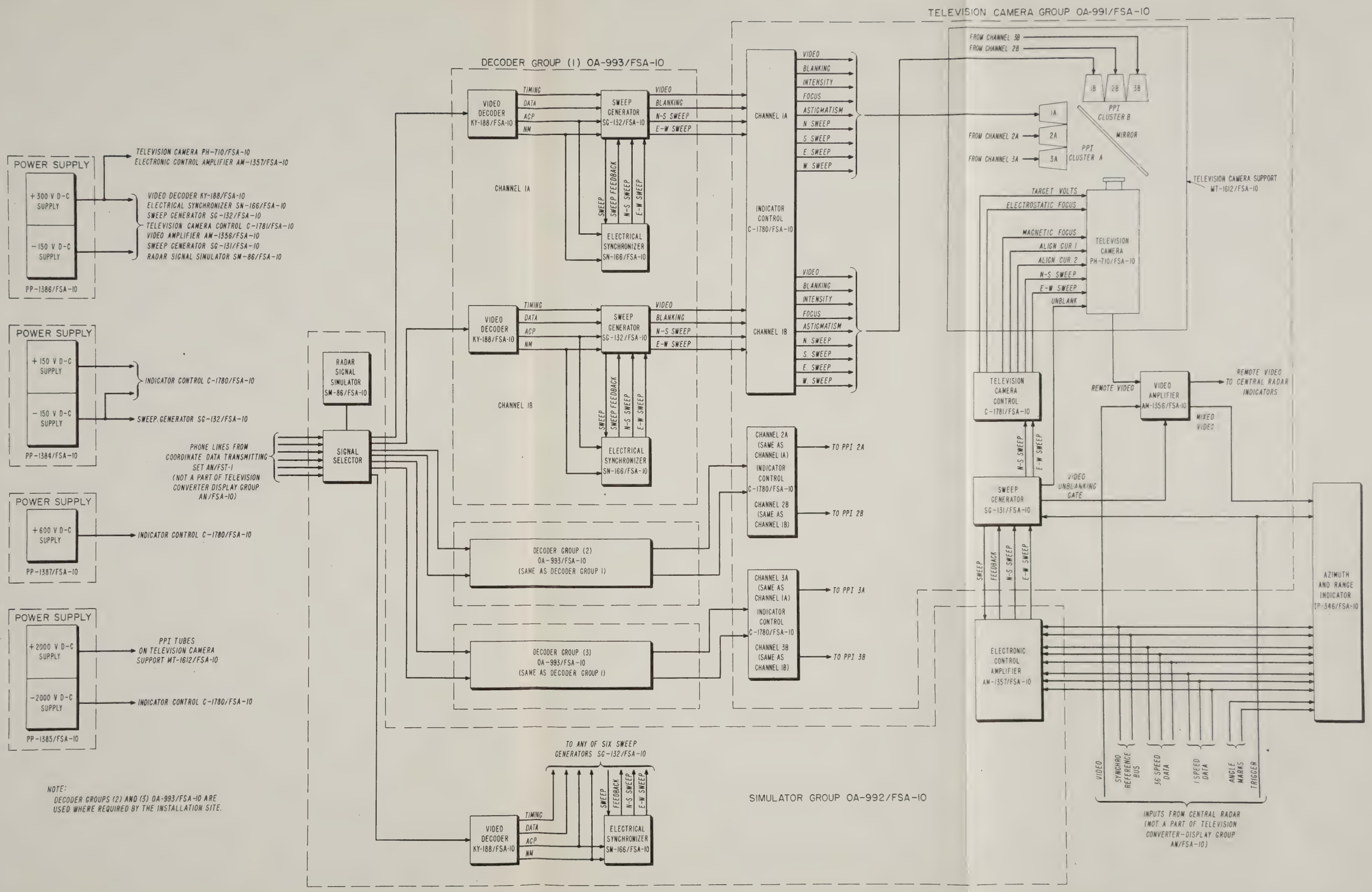


Figure 1-3. Television Converter-Display Group AN/FSA-10, Functional Block Diagram

SECTION II

LOGISTICAL DATA

2-1. POWER REQUIREMENTS AND TOLERANCES.

2-2. Table II lists the power source requirements and tolerances for Television Converter-Display Group AN/FSA-10.

2-3. SHIPPING AND STORAGE.

2-4. Table III lists the shipping and storage data for Television Converter-Display Group AN/FSA-10.

TABLE II
TELEVISION CONVERTER-DISPLAY GROUP AN/FSA-10, POWER SOURCE REQUIREMENTS

REQUIREMENT	DESCRIPTION		
a. Voltage.	*Nominal*	*Extreme*	
	120 volts single phase or 208 volts three phase, center-tapped wye.	105 to 130 volts single phase or 105 to 130 volts from the center of each leg to the wye.	
b. Frequency.	*Nominal*	*Extreme*	
	60 cps ±1 cps	60 cps ±2 cps	
c. Line Current.	*Basic AN/FSA-10*	*Augmentation Capability (FC-2-07A)*	
	Basic AN/FSA-10	One Decoder Group OA-993/FSA-10	Two Decoder Groups OA-993/FSA-10
	35 amp.	45 amp.	55 amp.

TABLE III
SHIPPING AND STORAGE DATA

COMPONENT OR UNIT	BOX DIMENSIONS (L x W x H) (INCHES)	PACKED WEIGHT (POUNDS)	BOX VOLUME (CUBIC FEET)	BOX NUMBER
6 Cathode Ray Tubes 2 Electron Tubes, Type 836 2 Electron Tubes, Type 25T	19 x 21 x 19	45	4.4	14
Television Camera PH-710/FSA-10 11-inch Mirror	22 x 23 x 20	65	5.8	13
Decoder Group OA-993/FSA-10 less two Electrical Synchronizers SN-166/FSA-10	115 x 42 x 46	1290	125.0	4
Decoder Group OA-993/FSA-10 Interconnecting Cable Set	25 x 25 x 13	45	4.7	5
Electrical Synchronizer SN-166/FSA-10	25 x 27 x 16	65	6.2	6
Electrical Synchronizer SN-166/FSA-10	25 x 27 x 16	65	6.2	7

TABLE III—Continued

COMPONENT OR UNIT	BOX DIMENSIONS (L x W x H) (INCHES)	PACKED WEIGHT (POUNDS)	BOX VOLUME (CUBIC FEET)	BOX NUMBER
Lower section of Television Camera Group OA-991/FSA-10 less two Electron Tubes Type 25T from Power Supply PP-1385/FSA-10	79 x 54 x 58	1630	145.0	11
Television Camera Support MT-1612/FSA-10 less the Mirror, Television Camera PH-710/FSA-10 and six three-inch Cathode Ray Tubes Camera Tube	50 x 41 x 41	410	54.0	12
Upper section of Electrical Equipment Cabinet CY-1969/FSA-10	37 x 39 x 35	395	45	15
Simulator Group OA-992/FSA-10 less Cable Boom and Cable, two Electron Tubes, Type 836, from Power Supply PP-1387/FSA-10 and Electrical Synchronizer SN-166/FSA-10. 3 Troubleshooting Manuals and 1 set of Instruction Books	115 x 42 x 46	1420	125	1
Cable Boom and Cable and System Interconnecting Cable Set less Decoder Group OA-993/FSA-10 Interconnecting Cable Set	52 x 22 x 12	190	8.0	2
Electrical Synchronizer SN-166/FSA-10	25 x 27 x 16	65	6.2	3
Azimuth and Range Indicator IP-346/FSA-10 less 16-inch Cathode Ray Tube, High Voltage Power Supply and Range Strobe Unit	57 x 32 x 40	480	42.0	8
High Voltage Power Supply and Range Strobe Unit	40 x 23 x 23	135	12.5	9
16-inch Cathode Ray Tube	21 x 21 x 19	50	7.4	10

2-5. EQUIPMENT FURNISHED.

2-6. Table IV lists the equipment furnished for installation of Television Converter-Display Group AN/FSA-10.

2-7. EQUIPMENT REQUIRED BUT NOT FURNISHED.

2-8. Table V lists the equipment required but not furnished with Television Converter-Display Group AN/FSA-10.

TABLE IV
TELEVISION CONVERTER-DISPLAY GROUP AN/FSA-10, EQUIPMENT FURNISHED

QUANTITY	COMPONENT OR UNIT	AN TYPE DESIGNATION OR WESTINGHOUSE PART NUMBER	CABLE RUN
1	*Decoder Group (Basic AN/FSA-10)	OA-993/FSA-10	
1	Simulator Group	OA-992/FSA-10	

TABLE IV—Continued

QUANTITY	COMPONENT OR UNIT	AN TYPE DESIGNATION OR WESTINGHOUSE PART NUMBER	CABLE RUN
1	Television Camera Group	OA-991/FSA-10	
1	Azimuth and Range Indicator	IP-346/FSA-10	
1	Special Purpose Electrical Cable Assembly	CX-3772/U	From Television Converter-Display Group AN/FSA-10 to central radar
1	20 Pin Connector		
4	Radio Frequency Cable Assembly	CG-1463/U	Three to central radar and one to central-radar indicator from Television Converter-Display Group AN/FSA-10
4	Connector	UG-260B/U	
1	Power Electrical Cable Assembly	CX-3773/U	From Television Converter-Display Group AN/FSA-10 to power source
1	Electrical Lead	CX-3777/U	From Television Converter-Display Group AN/FSA-10 to power source
1	Special Purpose Electrical Cable Assembly	CX-3771/U	From Simulator Group OA-992/FSA-10 to Azimuth and Range Indicator IP-346/FSA-10
1	Special Purpose Electrical Cable Assembly	CX-3770/U	From Simulator Group OA-992/FSA-10 to Television Camera Group OA-991/FSA-10
1	Power Electrical Cable Assembly	CX-3774/U	From Simulator Group OA-992/FSA-10 to Television Camera Group OA-991/FSA-10
1	Power Electrical Cable Assembly	CX-3774/U	From Decoder Group OA-993/FSA-10 to Simulator Group OA-992/FSA-10
1	Special Purpose Electrical Cable Assembly	CX-3768/U	From Decoder Group OA-993/FSA-10 to Simulator Group OA-992/FSA-10
1	Special Purpose Electrical Cable Assembly	CX-3769/U	From Decoder Group OA-993/FSA-10 to Television Camera Group OA-991/FSA-10

*Note

Each Decoder Group OA-993/FSA-10 is shipped with interconnecting cable assemblies CX-3774/U, CX-3768/U and CX-3769/U as listed above. All Decoder Groups use the same length interconnecting cable assemblies as supplied with each Decoder Group OA-993/FSA-10.

TABLE V

TELEVISION CONVERTER-DISPLAY GROUP AN/FSA-10, EQUIPMENT REQUIRED BUT NOT FURNISHED

EQUIPMENT	WHERE INSTALLED
Central radar set	Central-radar site with Television Converter-Display Group AN/FSA-10
Remote radar set	At the remote-radar site
Coordinate Data Transmitting Set AN/FST-1	At the remote-radar site
Central-radar indicators	At the operating site (must be modified to accept remote video)
Telephone lines—Both leased and Air Force owned (inside)	Connecting Coordinate Data Transmitting Set AN/FST-1 and Television Converter-Display Group AN/FSA-10.
Mounting hardware	Required to fasten the components of Television Converter-Display Group AN/FSA-10 to the floor
Coaxial cables	Interconnect central-radar indicators

2-9. TRANSPORTATION AND MATERIALS HANDLING REQUIREMENTS.

2-10. The equipment supplied with Television Converter-Display Group AN/FSA-10 is properly packaged to withstand normal handling encountered enroute when shipped through commercial carriers. Due to the bulk and weight of some items, a fork lift truck is required for local handling. No other special equipment is required to handle the crated or uncrated units.

2-11. BUILDING SPECIFICATION REQUIREMENTS.

2-12. Table VI outlines the housing requirements for Television Converter-Display Group AN/FSA-10. The dimensions listed provide the overall space requirements, including maintenance access considerations.

TABLE VI

TELEVISION CONVERTER-DISPLAY GROUP AN/FSA-10, BUILDING SPECIFICATION REQUIREMENTS

SPACE	REQUIREMENT
Floor	9 feet x 20 feet for Television Converter-Display Group AN/FSA-10. Add 2 feet of floor space to the long dimension for each additional Decoder Group OA-993/FSA-10. Loading—2900 lbs. add 634 lbs. for each additional Decoder Group OA-993/FSA-10. Maximum floor load—210 lbs./ft.^{2}. Must have cable trenches to house the interconnecting cables.
Ceiling	Minimum height 9 feet.
Room Ventilation	Natural ventilation or forced ventilation necessary to prevent the operating temperature from rising above the maximum set forth in Table I in Section I. Room must be heated to prevent the operating temperature from dropping below the minimum set forth in Table I in Section I. 22,000 BTU's per hour room ventilation is required.

SECTION III

INSTALLATION ENGINEERING

3-1. SITING.

3-2. GENERAL. Television Converter-Display Group AN/FSA-10 is designed for installation at the central-radar site. Television Converter-Display Group AN/FSA-10 should be installed in an annex to the building which houses the interior of the equipment of the central radar. The room in which Television Converter-Display Group AN/FSA-10 is installed should be at least 30 feet long, 25 feet wide and nine feet high. Detailed power requirements and other logistical data are listed in Section II.

3-3. INTERFERENCE CONSIDERATIONS. Television Converter-Display Group AN/FSA-10 is subject only to interference which may originate in the remote radar set or in the telephone lines or other link equipment. Weather interference at the remote radar may be of such magnitude as to produce false data. These data, if received, will be converted to false video by Television Converter-Display Group AN/FSA-10. Weather interference can be reduced only by changing the mode of r-f propagation and reception (e.g. circular polarization) at the remote-radar equipment site; no special provisions during installation need be considered. Interference which may originate in the telephone lines, such as spasmodic noise pulses, may cause erratic operation of Television Converter-Display Group AN/FSA-10 thereby resulting in range and azimuth error in the remote-radar video output. Telephone lines with low quiescent noise levels should be selected for use. Data grade telephone lines as furnished by the telephone company are adequate. Shielded, twisted wire pairs should be used for all runs of telephone wire between the line termination and Television Converter-Display Group AN/FSA-10.

3-4. CLIMATIC CONSIDERATIONS. Television Converter-Display Group AN/FSA-10 is designed for continuous operation at elevations up to 8,000 feet above sea level. Table I in Section I lists the temperature limits for operating and non-operating conditions. The non-operating period includes shipment and storage intervals. Television Converter-Display Group AN/FSA-10 will withstand the sand and dust as encountered in arid regions. All exposed materials will withstand the salt atmosphere encountered in coastal regions.

3-5. DATA TELEPHONE LINE CONSIDERATIONS. The remote-radar signal to Television Converter-Display Group AN/FSA-10 is transmitted over telephone company data grade two-wire, 600-ohm telephone lines (or equivalent quality). The telephone line signal consists of a two-kc carrier that is amplitude modulated with azimuth change pulses, north mark pulses, timing pulses, and data pulses. The pulses occur at a maximum rate of 1600 pps. Either type K or type C carrier telephone lines may be used for transmission of the signal. At the transmitting end of these lines, the modulated two-kc carrier is heterodyned with a high-frequency local oscillator signal. The upper sideband is then transmitted. At the receiving end of the phone line, the signal is heterodyned against a high-frequency oscillator and the lower sideband recovered. The modulated two-kc signal is thus recovered. The two high-frequency oscillators in the type K or C lines are not synchronized although their frequencies are nearly equal. The frequency discrepancy causes the phase of the two-kc carrier to change but the relation of the two-kc carrier to its sidebands remains unchanged. Thus, the original modulation is recovered when the signal is demodulated in Video Decoder KY-188/FSA-10. It is possible that an unusual transient phenomenon may occur in the telephone line causing it to go dead and resulting in a complete loss of signal to Television Converter-Display Group AN/FSA-10 for a short period of time (10-15 azimuth change pulses). A standby, normally-squelched pulse generator in Electrical Synchronizer SN-166/FSA-10 produces dummy azimuth change pulses during the period when the remote-radar signal is missing. Thus, azimuthal synchronism between the three-inch PPI sweep and its associated remote radar is maintained.

3-6. CIRCUIT BREAKER PROTECTION CONSIDERATIONS. All power supply input and output circuits in Television Converter-Display Group AN/FSA-10 are protected by fuses or circuit breakers. It is recommended that additional circuit breaker protection be provided at the main power line disconnect switch.

3-7. LOCATION LIMITATIONS.

3-8. The principal limitation to the location of the components of Television Converter-Display Group AN/FSA-10 is the requirement that Azimuth and Range Indicator IP-346/FSA-10 may be observed when any operating or adjustment control is adjusted. This requirement makes it necessary to locate Simulator Group OA-992/FSA-10, to which Azimuth and Range Indicator IP-346/FSA-10 is directly interconnected, centrally in Television Converter-Display Group AN/FSA-10. Figure 3-1 at the end of this section shows a recommended layout for Television Converter-Display Group AN/FSA-10. If the components are located and oriented as shown in figure 3-1, it should be possible to view the scope of Azimuth and Range Indicator IP-346/FSA-10 when any control of Television Converter-Display Group AN/FSA-10 is adjusted. The relationship of other equipments to Television Converter-Display Group AN/FSA-10 does not affect the location of components.

3-9. LIMITATIONS OF EQUIPMENT LAYOUT VARIATIONS.

3-10. Whenever possible, layout of the equipments of Television Converter-Display Group AN/FSA-10 should not vary from that indicated in figure 3-1 at the end of this section. Such a layout permits observation of Azimuth and Range Indicator IP-346/FSA-10 when any control is adjusted. Access doors are provided at the front and rear of each cabinet. Thus, space must be allowed for open doors and for locating test equipment in the area when the doors are open. Additional space must be allowed in the front of the cabinets to permit moving Azimuth and Range Indicator IP-346/FSA-10 to the various control locations when adjustments are made. All cables and connectors required for interconnecting the components of Television Converter-Display Group AN/FSA-10 are supplied prefabricated for the equipment layout shown in figure 3-1. Since each cabinet is designed for bottom cable entry, cable trenches are required as shown in figure 3-1. Any variation in the equipment layout would require modification of the trench layout plan. It should also be noted that the cable trenches should have special cutouts to permit running the cables into the cabinets. (See figure 3-1.) Straight wall trench construction may be used, however, with the cabinets mounted over the trench. A special trench cover will then be required in order to cover the cables. Either type of trench construction must provide a smooth floor surface in order that Azimuth and Range Indicator IP-346/FSA-10 may be moved about. Mounting and installation details of the components of Television Converter-Display Group AN/FSA-10 may be obtained from figures 3-2 through 3-5 at the end of this section.

3-11. EXTERNAL CABLING AND TERMINATION SPECIFICATIONS.

3-12. Table IV in Section II lists the interconnecting cable assemblies furnished with Television Converter-Display Group AN/FSA-10. Special Purpose Electrical Cable Assembly CX-3772/U is terminated in terminal lugs at the Television Converter-Display Group AN/FSA-10 end and is unterminated at the central-radar end. A 20-pin connector is supplied for field installation after the cable has been trimmed. Refer to the Handbook Service Instructions for the central radar set to locate the jack that mates with this connector. The cable consists of #20 tinned copper braid conductors and two #14 tinned copper braid conductors. Paragraph 4-23 in Section IV describes details for connecting the cable.

3-13. Four Radio Frequency Cable Assemblies CG-1463/U are supplied as indicated in Table IV of Section II. Each cable assembly is terminated in two terminal lugs at the Television Converter-Display Group AN/FSA-10 end and is unterminated at the other end. The connectors, UG-260B/U, are supplied for field installation after the cables have been trimmed. Paragraph 4-23 in Section IV describes details for connecting the cable.

3-14. One Power Electrical Cable Assembly CX-3773/U is supplied terminated with three terminal lugs at the Television Converter-Display Group AN/FSA-10 end and unterminated at the power source end. Connectors at the power source end of this cable must be provided by the installing activity.

3-15. One Electrical Lead CX-3777/U is supplied for the neutral connection to the power source. The Television Converter-Display Group AN/FSA-10 end is terminated with one terminal lug. The connector for the power source end must be supplied by the installing activity.

3-16. The cable grommet 5, figure 3-3, in the cable entrance plate of Simulator Group OA-992/FSA-10 is used for protection of the telephone lines. The number of telephone lines used depends upon the number of channels required by the operating site.

3-17. FUNCTIONAL BLOCK DIAGRAM AND SYSTEM SIGNAL FLOW.

3-18. A functional block diagram of Television Converter-Display Group AN/FSA-10 is shown in figure 1-3 at the end of Section I. The system signal flow is described in paragraph 1-7 in Section I.

3-19. PHYSICAL DIMENSIONS OF COMPONENTS.

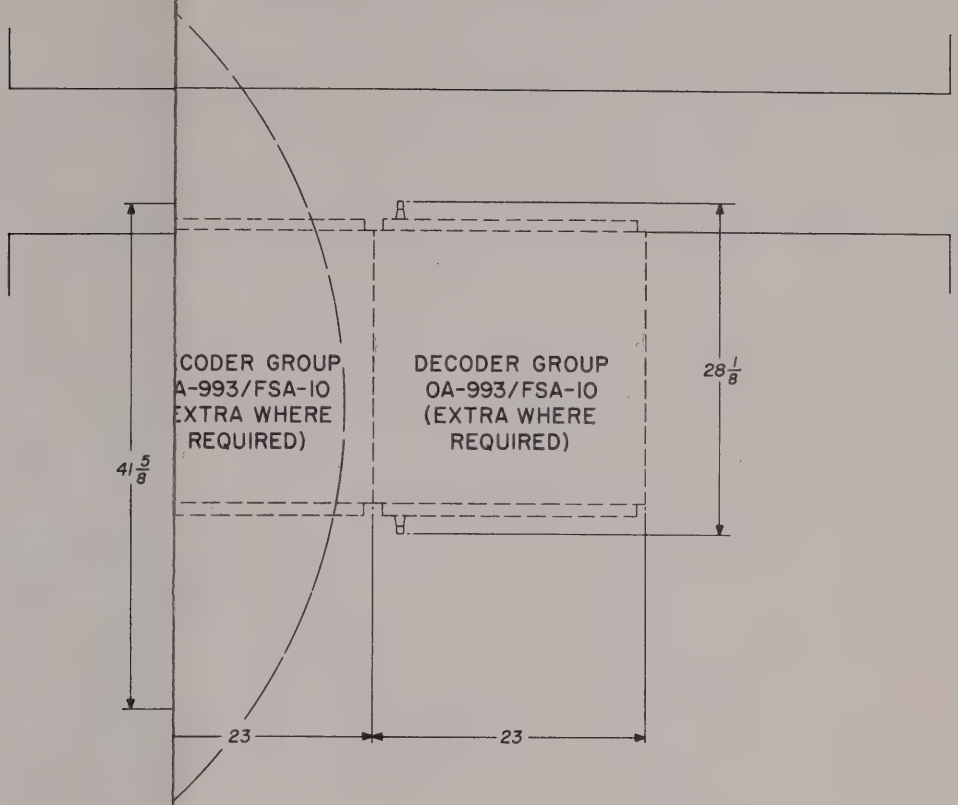
3-20. Table VII lists the overall dimensions of the components of Television Converter-Display Group AN/FSA-10.

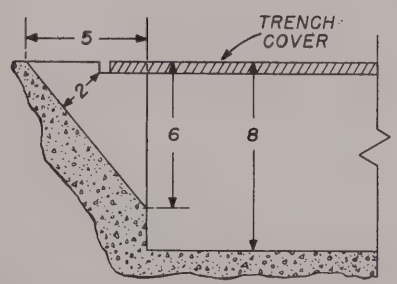
3-21. PREFERRED METHODS.

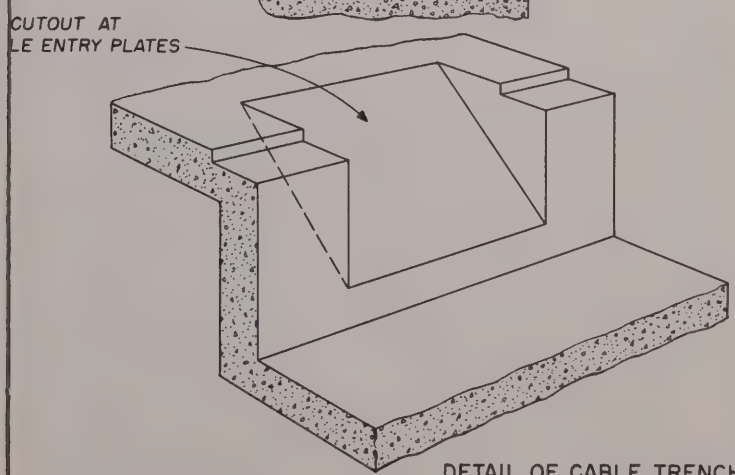
3-22. The telephone lines required for transmission of the remote-radar data as converted by Coordinate Data Transmitting Set AN/FST-1 should be, as stated in paragraph 3-5, two-wire, 600-ohm, data grade lines. If installations are made where no commercial telephone lines are available for lease or where telephone lines cannot be strung because of terrain or other topographic considerations, equivalent wireless facilities such as Radio Set AN/TRC-1 (or AN/TRC-8) may be utilized. In conjunction with these equipments, carrier-bay equipment such as Telephone Terminal AN/TCC-3 (or AN/TCC-7) may be used. If use of these equipments is contemplated, reference should be made to the pertinent instructions Technical Orders.

TABLE VII
PHYSICAL DIMENSIONS OF COMPONENTS

COMPONENT	DIMENSIONS INCLUDING HANDLES (INCHES) (L x W x H)	WEIGHT (POUNDS)	VOLUME (CUBIC FEET)
Decoder Group OA-993/FSA-10	$90\frac{3}{8}$ x 23 x $28\frac{5}{8}$	634	35.6
Simulator Group OA-992/FSA-10	$90\frac{3}{8}$ x 23 x $28\frac{5}{8}$	765	35.6
Television Camera Group OA-991/FSA-10	75 x 54 x $41\frac{5}{8}$	1117	84.3
Azimuth and Range Indicator IP-346/FSA-10	30 front, 41 rear, x 23 x $28\frac{13}{16}$	261	15.6







DETAIL OF CABLE TRENCH

olay Group AN/FSA-10, Typical Equipment Layout Diagram

3-21. PREFERRED METHODS.

3-22. The telephone lines required for transmission of the remote-radar data as converted by Coordinate Data Transmitting Set AN/FST-1 should be, as stated in paragraph 3-5, two-wire, 600-ohm, data grade lines. If installations are made where no commercial telephone lines are available for lease or where telephone lines cannot be strung because of terrain or other topographic considerations, equivalent wireless facilities such as Radio Set AN/TRC-1 (or AN/TRC-8) may be utilized. In conjunction with these equipments, carrier-bay equipment such as Telephone Terminal AN/TCC-3 (or AN/TCC-7) may be used. If use of these equipments is contemplated, reference should be made to the pertinent instructions Technical Orders.

TABLE VII
PHYSICAL DIMENSIONS OF COMPONENTS

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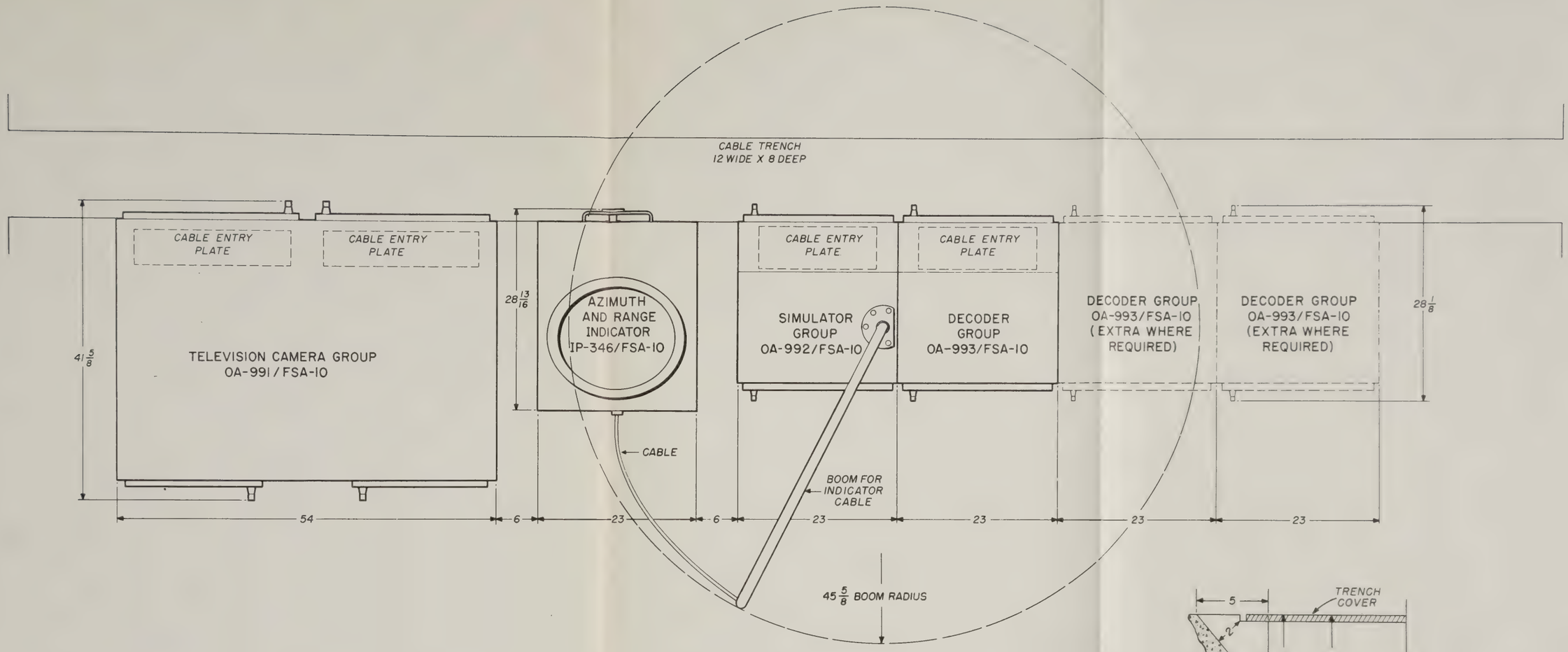


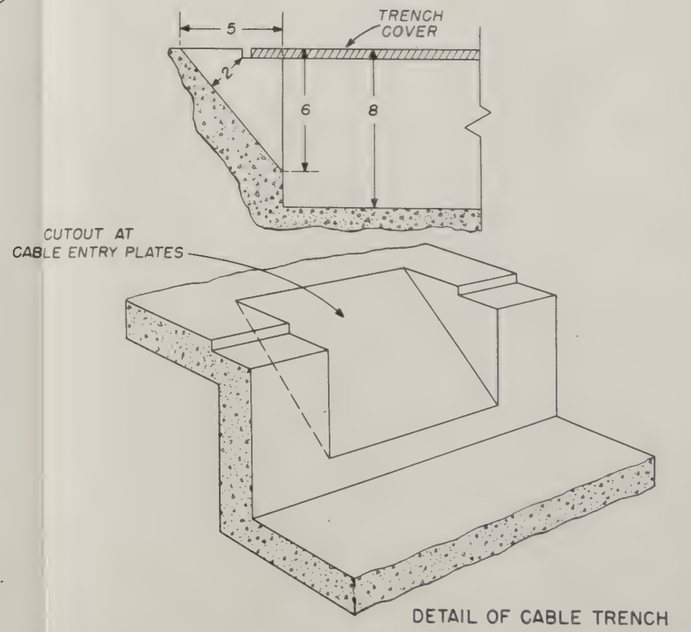
NOTES:

(1) AZIMUTH AND RANGE INDICATOR IP-346/FSA-10 IS MOUNTED ON CASTERS AND CAN BE RELOCATED WITHIN THE BOOM RADIUS AND CABLE LENGTH.

(2) A SPACE OF 1/2 BETWEEN SIMULATOR GROUP OA-992/FSA-10 AND/OR DECODER GROUP(S) OA-993/FSA-10 MAY BE REQUIRED TO CLEAR PROTRUDING HARDWARE.

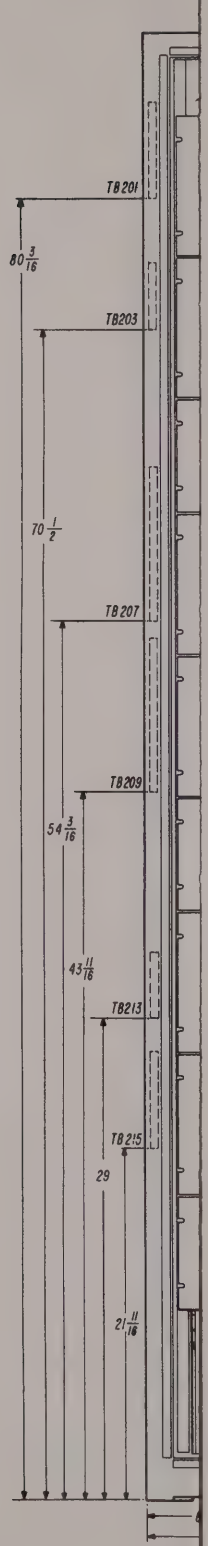
(3) ALL DIMENSIONS ARE IN INCHES.

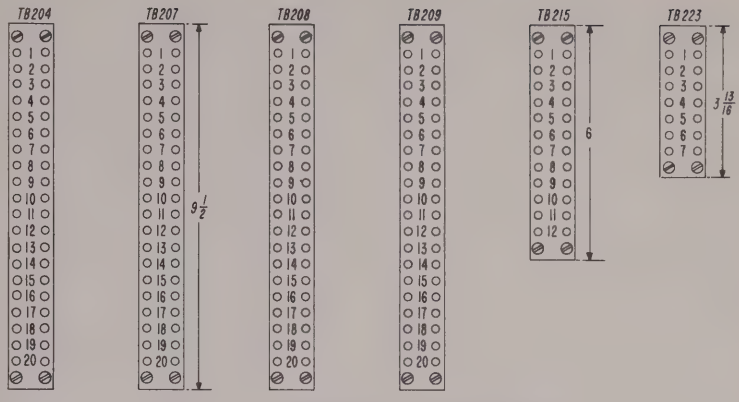
(4) ALLOW AT LEAST 6 CLEARANCE AT THE END OF TELEVISION CAMERA GROUP OA-991/FSA-10 FOR VENTILATION.



DETAIL OF CABLE TRENCH

Figure 3-1. Television Converter-Display Group AN/FSA-10, Typical Equipment Layout Diagram





TERMINAL BOARDS USED DURING INSTALLATION FOR LOCATION OF TERMINAL BOARDS SEE FRONT AND TOP VIEWS.

NOTES

CABLE ENTRANCE PLATE IS REMOVABLE FOR PULLING CABLES THROUGH TRENCH.

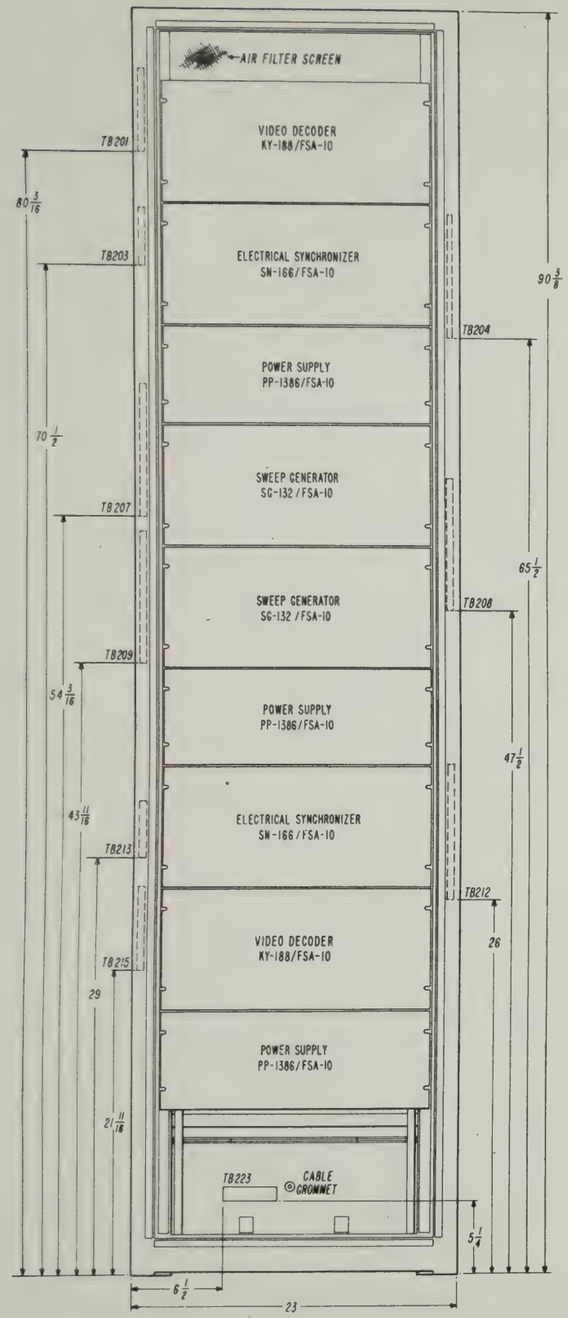
FOR DRILLING PLAN REFER TO BOTTOM VIEW.

CABLE ENTRANCE PLAN;
1-HOLE FOR INTERCONNECTING CABLE FROM SIMULATOR GROUP OA-992/FSA-10.
2-HOLE FOR INTERCONNECTING CABLE FROM TELEVISION CAMERA GROUP OA-991/FSA-10.
A-HOLES FOR A-C BYPASS CAPACITOR
B-HOLES FOR A-C BYPASS CAPACITOR MOUNTING BRACKETS.

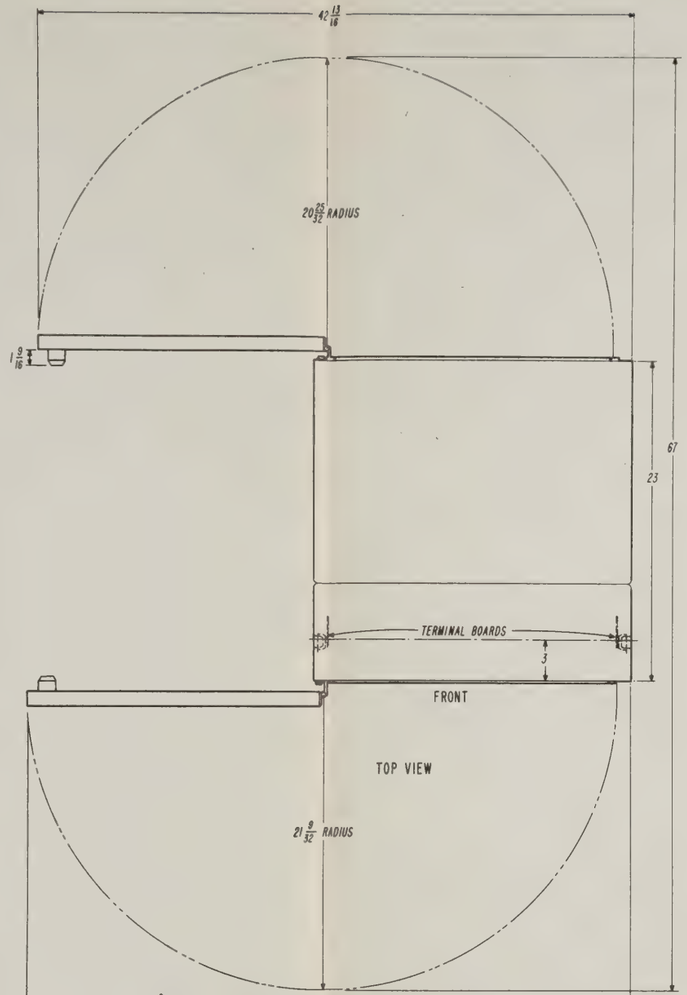
ALL DIMENSIONS ARE IN INCHES.

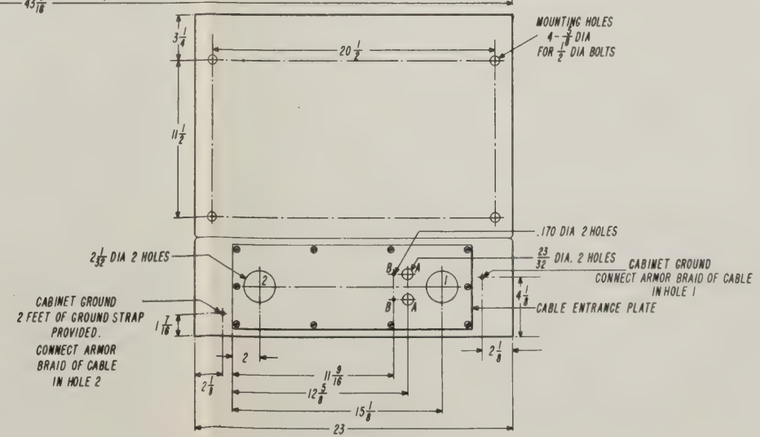
OA-993/FSA-10, Mounting and Installation Details

T.O. No. 31S1-2FSA10-5

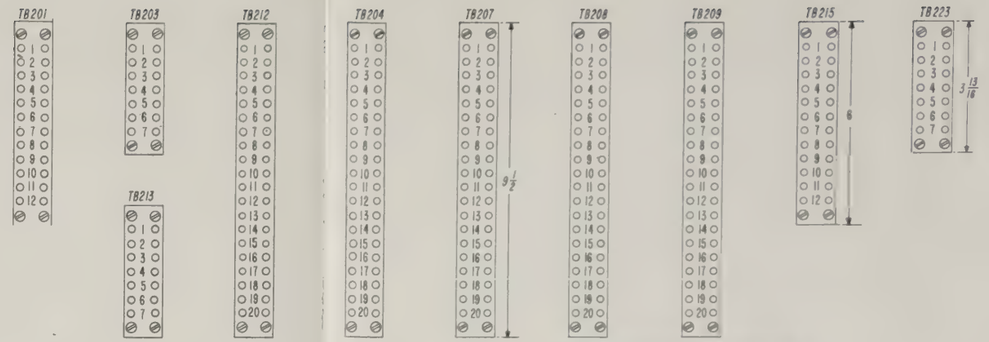


FRONT VIEW
DOOR AND HINGES REMOVED





CABLE ENTRANCE (BOTTOM VIEW)



TERMINAL BOARDS USED DURING INSTALLATION FOR LOCATION OF TERMINAL BOARDS SEE FRONT AND TOP VIEWS.

NOTES

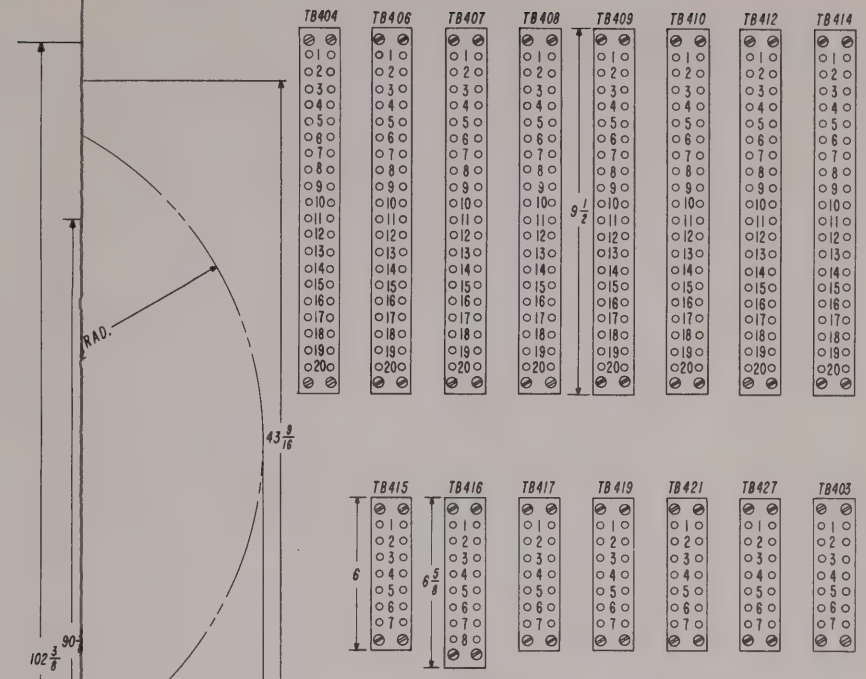
CABLE ENTRANCE PLATE IS REMOVABLE FOR PULLING CABLES THROUGH TRENCH.

FOR DRILLING PLAN REFER TO BOTTOM VIEW.

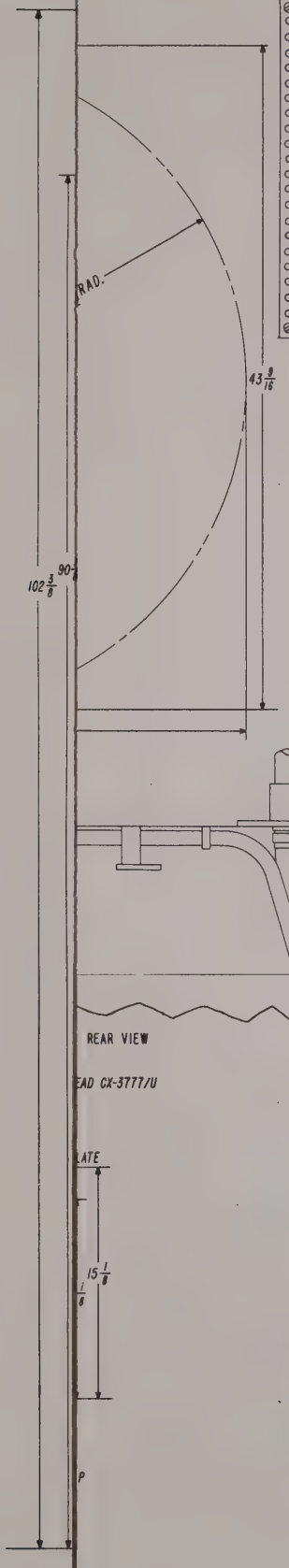
CABLE ENTRANCE PLAN:
1-HOLE FOR INTERCONNECTING CABLE FROM SIMULATOR GROUP OA-992/FSA-10.
2-HOLE FOR INTERCONNECTING CABLE FROM TELEVISION CAMERA GROUP OA-991/FSA-10.
A-HOLES FOR A-C BYPASS CAPACITOR.
B-HOLES FOR A-C BYPASS CAPACITOR MOUNTING BRACKETS.

ALL DIMENSIONS ARE IN INCHES.

Figure 3-2. Decoder Group OA-993/FSA-10, Mounting and Installation Details



TERMINAL BOARDS USED DURING INSTALLATION
FOR LOCATION OF TERMINAL BOARDS SEE
FRONT AND TOP VIEWS.



NOTES

CABLE ENTRANCE PLATE IS REMOVABLE FOR PULLING CABLES THROUGH TRENCH.

FOR DRILLING PLAN REFER TO BOTTOM VIEW.

1-HOLE FOR INTERCONNECTING CABLE FROM DECODER GROUP OA-993/FSA-10.

2,3-HOLES FOR CABLES FROM ADDITIONAL DECODER GROUPS OA-993/FSA-10 IF USED.

4-HOLE FOR INTERCONNECTING CABLE FROM CENTRAL RADAR

5-HOLE FOR PHONE LINE FROM REMOTE RADAR.

6-HOLE FOR INTERCONNECTING CABLE FROM TELEVISION CAMERA GROUP OA-991/FSA-10.

7-HOLE FOR INTERCONNECTING CABLE FROM AZIMUTH AND RANGE INDICATOR IP-346/FSA-10.

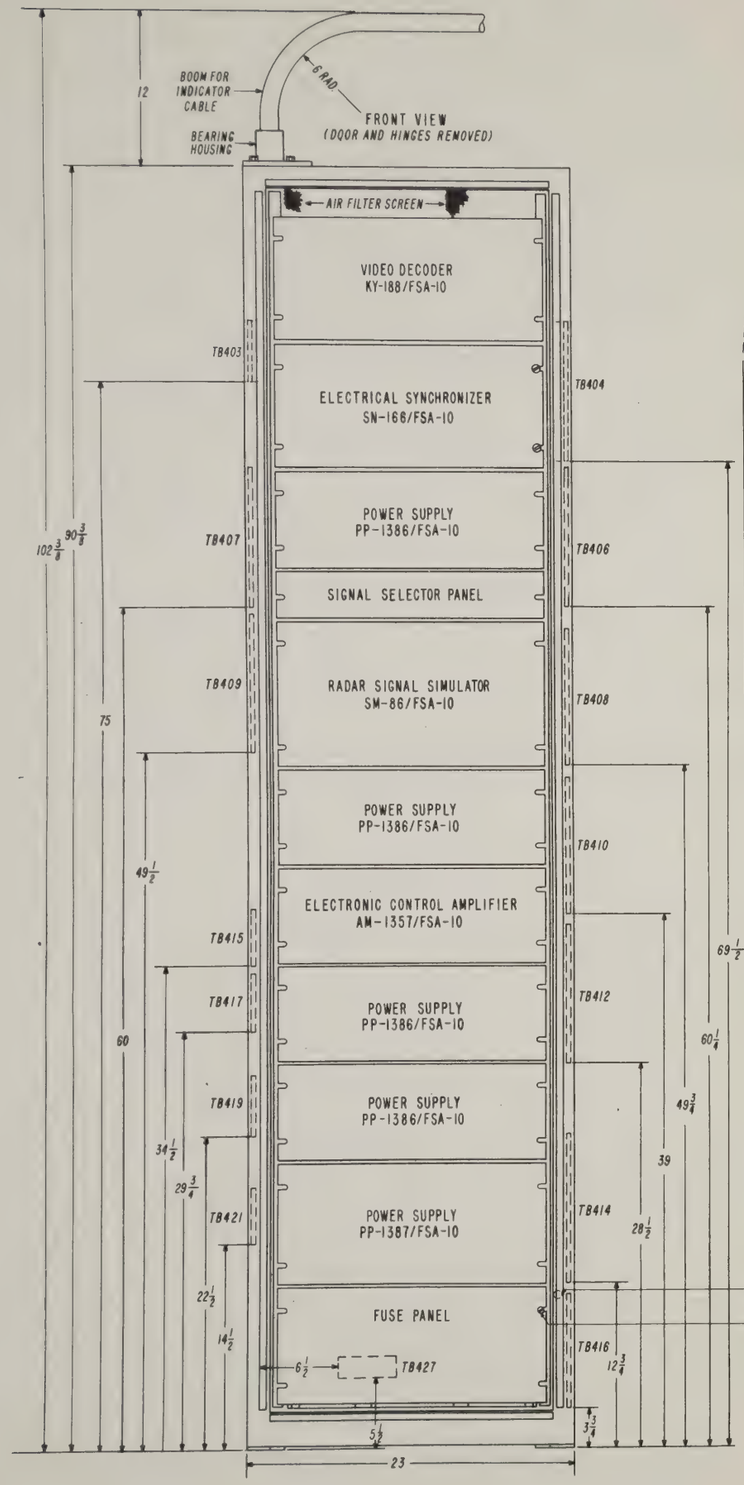
ALL DIMENSIONS ARE IN INCHES.

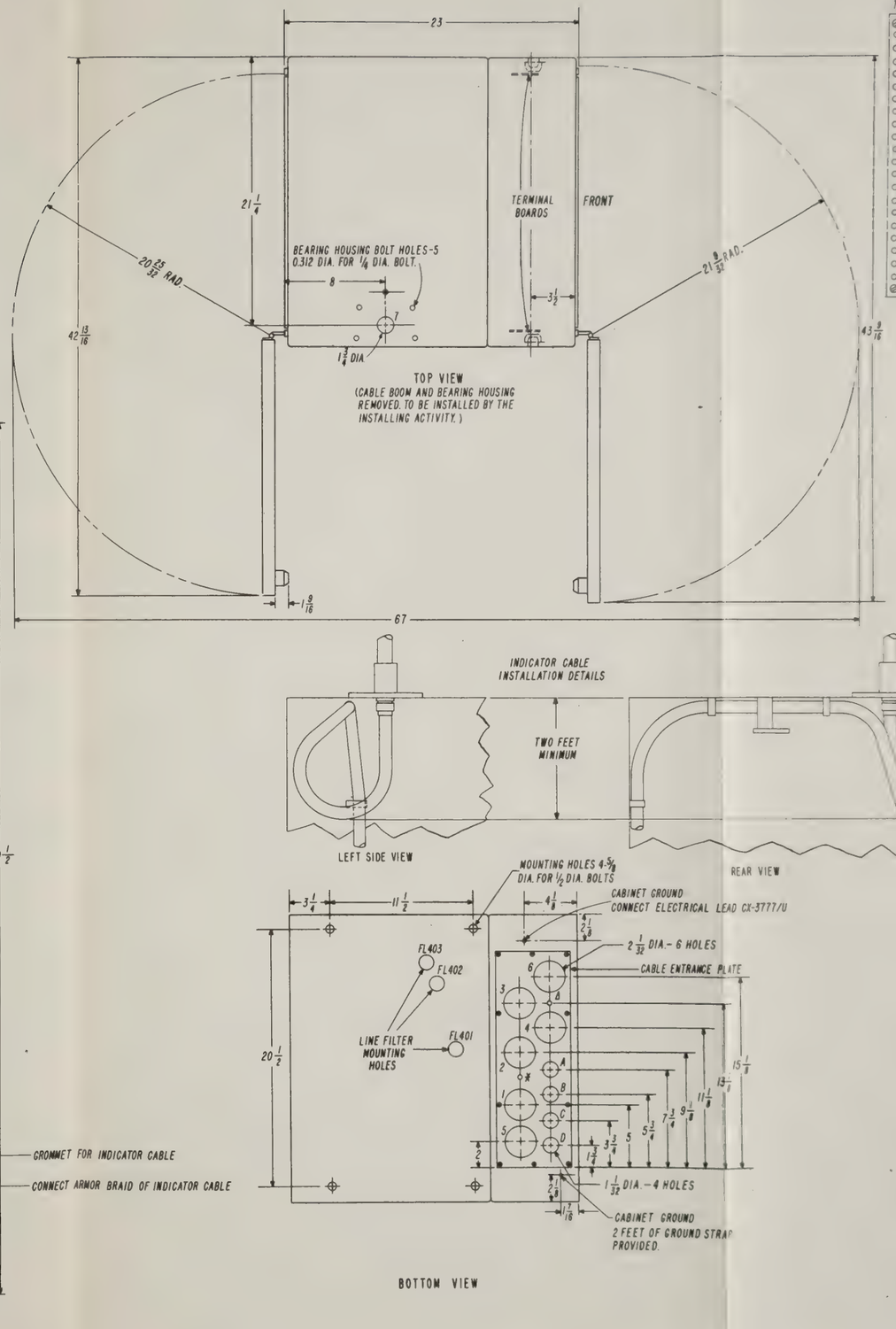
A-C POWER CABLES
- A-TO TELEVISION CAMERA GROUP OA-991/FSA-10
- B-TO DECODER GROUP 1 OA-993/FSA-10
- C-TO DECODER GROUP 2 OA-993/FSA-10
- D-TO DECODER GROUP 3 OA-993/FSA-10

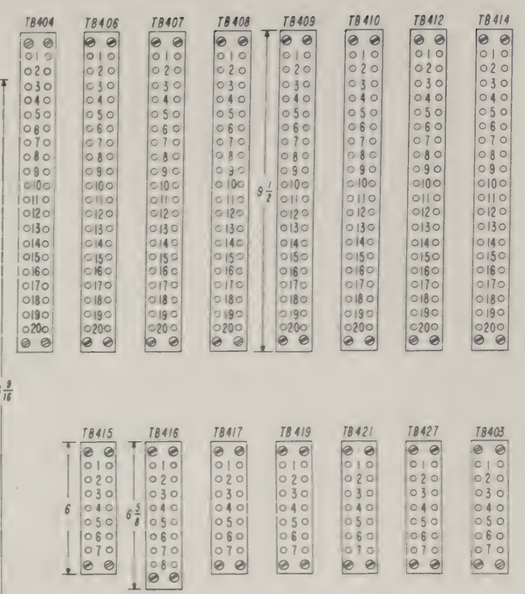
*CONNECT ARMOR BRAID OF CABLES IN HOLES 1 AND 2
Δ CONNECT ARMOR BRAID OF CABLE IN HOLE 6

...p OA-992/FSA-10, Mounting and Installation Details

T.O. No. 31S1-2FSA10-5




23
TERMINAL BOARDS
FRONT
BEARING HOUSING BOLT HOLES-5 0.312 DIA. FOR 1/4 DIA. BOLT.
TOP VIEW (CABLE BOOM AND BEARING HOUSING REMOVED. TO BE INSTALLED BY THE INSTALLING ACTIVITY.)
67
INDICATOR CABLE INSTALLATION DETAILS
TWO FEET MINIMUM
LEFT SIDE VIEW
REAR VIEW
MOUNTING HOLES 4-5/8 DIA. FOR 1/2 DIA. BOLTS
CABINET GROUND CONNECT ELECTRICAL LEAD CX-3777/U
2 1/32 DIA.- 6 HOLES
CABLE ENTRANCE PLATE
FL403
FL402
FL401
LINE FILTER MOUNTING HOLES
1 1/32 DIA.- 4 HOLES
CABINET GROUND 2 FEET OF GROUND STRAP PROVIDED.
BOTTOM VIEW



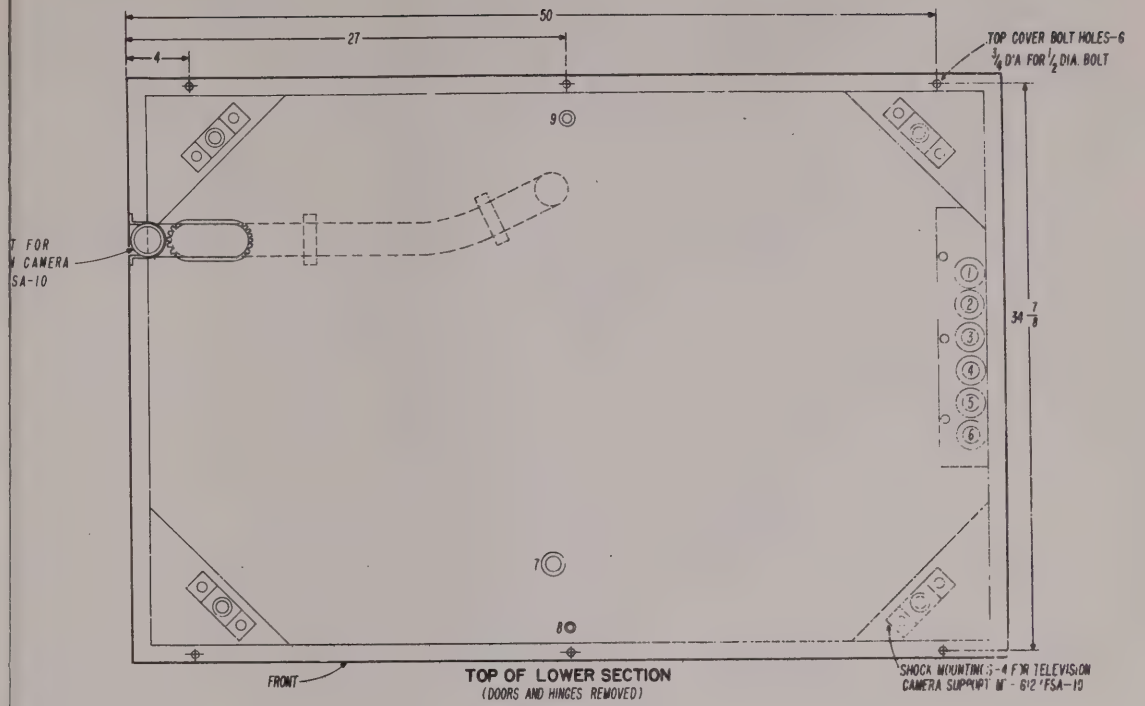
NOTES

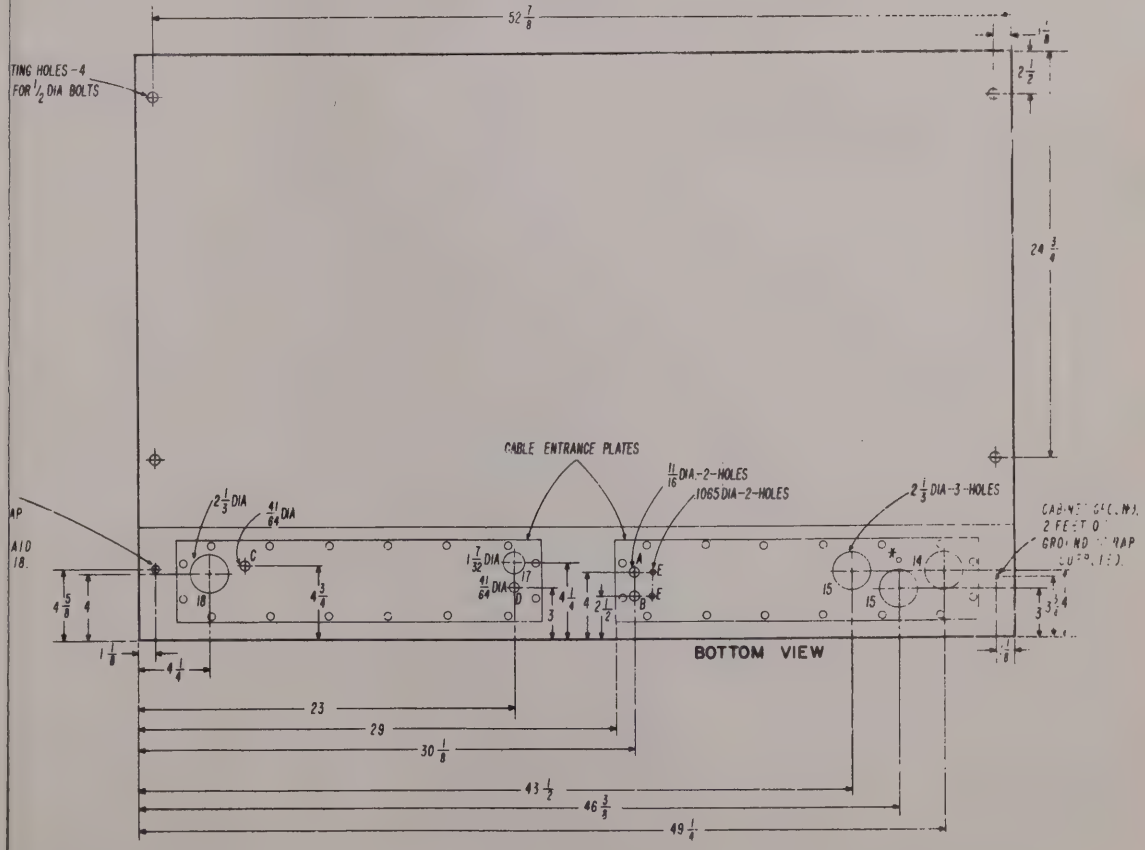
CABLE ENTRANCE PLATE IS REMOVABLE FOR PULLING CABLES THROUGH TRENCH.
FOR DRILLING PLAN REFER TO BOTTOM VIEW.
1-HOLE FOR INTERCONNECTING CABLE FROM DECODER GROUP OA-993/FSA-10.
2,3-HOLES FOR CABLES FROM ADDITIONAL DECODER GROUPS OA-993/FSA-10 IF USED.
4-HOLE FOR INTERCONNECTING CABLE FROM CENTRAL RADAR
5-HOLE FOR PHONE LINE FROM REMOTE RADAR.
6-HOLE FOR INTERCONNECTING CABLE FROM TELEVISION CAMERA GROUP OA-991/FSA-10.
7-HOLE FOR INTERCONNECTING CABLE FROM AZIMUTH AND RANGE INDICATOR IP-346/FSA-10.
ALL DIMENSIONS ARE IN INCHES.

A-C POWER CABLES
- A-TO TELEVISION CAMERA GROUP OA-991/FSA-10
- B-TO DECODER GROUP 1 OA-993/FSA-10
- C-TO DECODER GROUP 2 OA-993/FSA-10
- D-TO DECODER GROUP 3 OA-993/FSA-10

*CONNECT ARMOR BRAID OF CABLES IN HOLES 1 AND 2
Δ CONNECT ARMOR BRAID OF CABLE IN HOLE 6

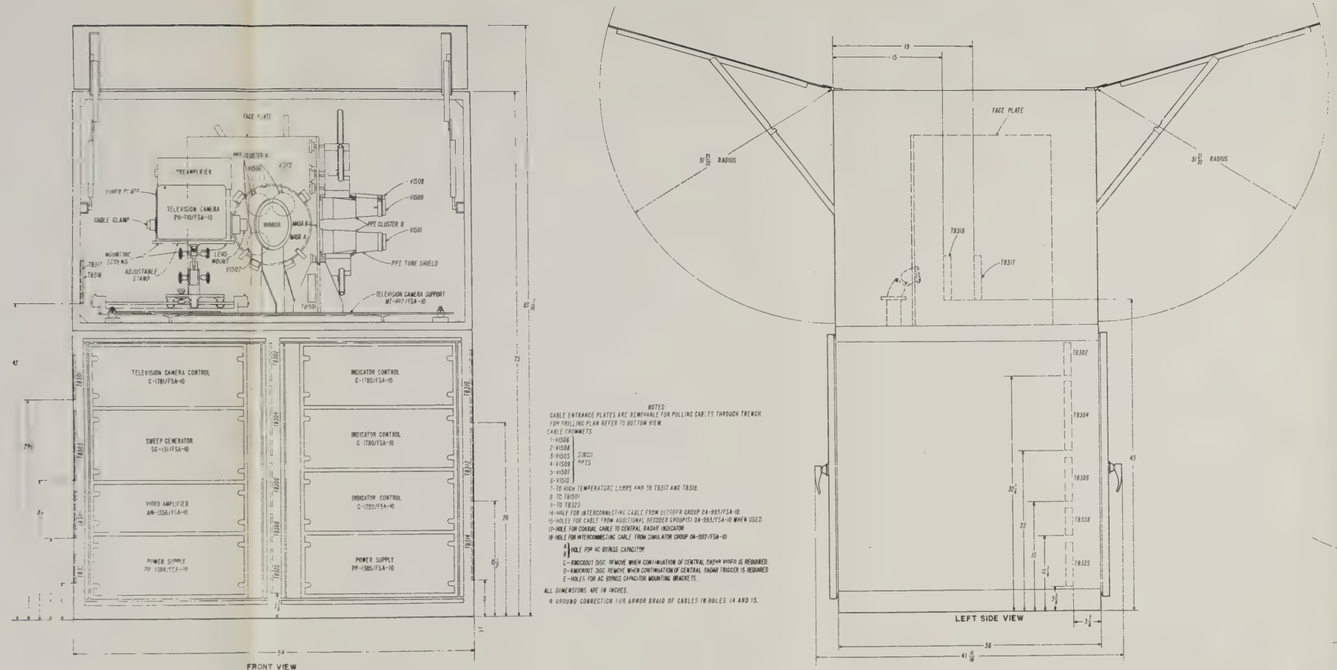
Figure 3-3. Simulator Group OA-992/FSA-10, Mounting and Installation Details





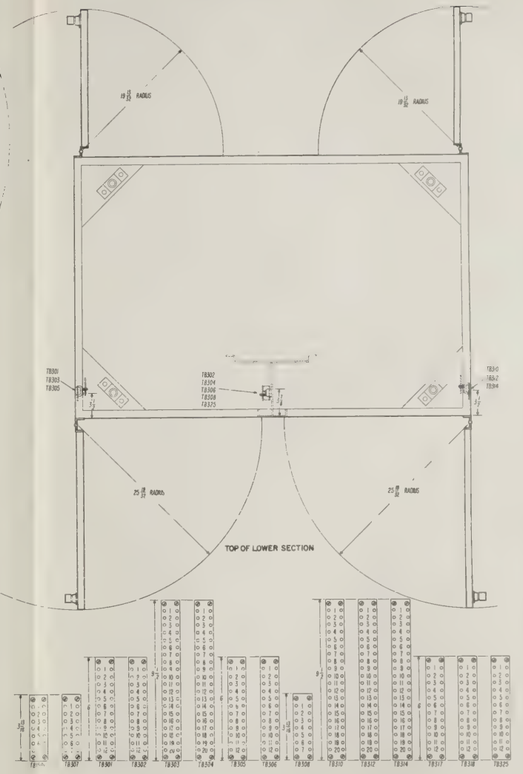
ure 3-4. Television Camera Group OA-991/FSA-10, Mounting and Installation De'ails

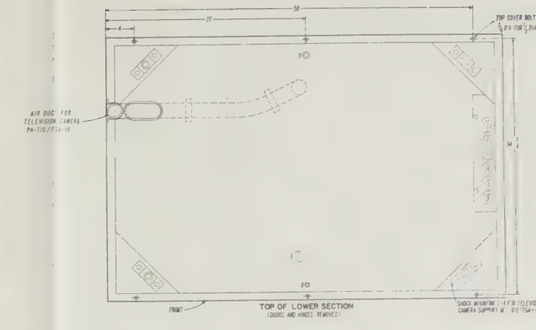
T.O. No. 31S1-2FSA10-5



NOTES:
CABLE ENTRANCE PLATES ARE REMOVABLE FOR PULLING CABLES THROUGH TRENCH.
FOR PULLING PLAN REFER TO BOTTOM VIEW.
CABLE ENTRANCES
1-V1506
2-V1508
3-V1505 } DIRECT
4-V1509 } PATH
5-V1507
6-V1510
7-TO HIGH TEMPERATURE LAMPS AND TO TB317 AND TB318.
8-TO TB1511
9-TO TB323
10-HOLE FOR INTERCONNECTING CABLE FROM SCOPE GROUP OA-997/FSA-10.
11-HOLES FOR CABLE FROM ADDITIONAL DECODER GROUPS OA-993/FSA-10 WHEN USED.
12-HOLE FOR COAXIAL CABLE TO CENTRAL RADAR INDICATOR
13-HOLE FOR INTERCONNECTING CABLE FROM SIMULATOR GROUP OA-992/FSA-10
14 HOLE FOR AC BYPASS CAPACITOR
C-CIRCUIT DISC. IF/NONE WHEN CONFIGURATION OF CENTRAL RADAR VIDEO IS REQUIRED.
D-KNOCKOUT DISC. REMOVE WHEN CONFIGURATION OF CENTRAL RADAR TRIGGER IS REQUIRED
E-HOLES FOR AC BYPASS CAPACITOR MOUNTING BRACKETS.
ALL DIMENSIONS ARE IN INCHES.
4 GROUND CONNECTION FOR ARMOR BRAID OF CABLES IN HOLES 14 AND 15.

T.O. No. 31S1-2FSA10-5




TOP COVER BOLT HOLES-4 DIA FOR 3/4 DIA BOLT
AIR DUCT FOR TELEVISION CAMERA PH-1110/FSA-10
TOP OF LOWER SECTION
(DOORS AND HINGES REMOVED)
FRONT
SHOCK MOUNTING C-1478 TELEVISION CAMERA SUPPORT MT-1107/FSA-10

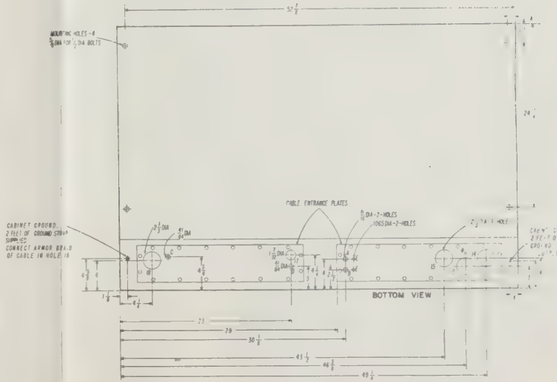
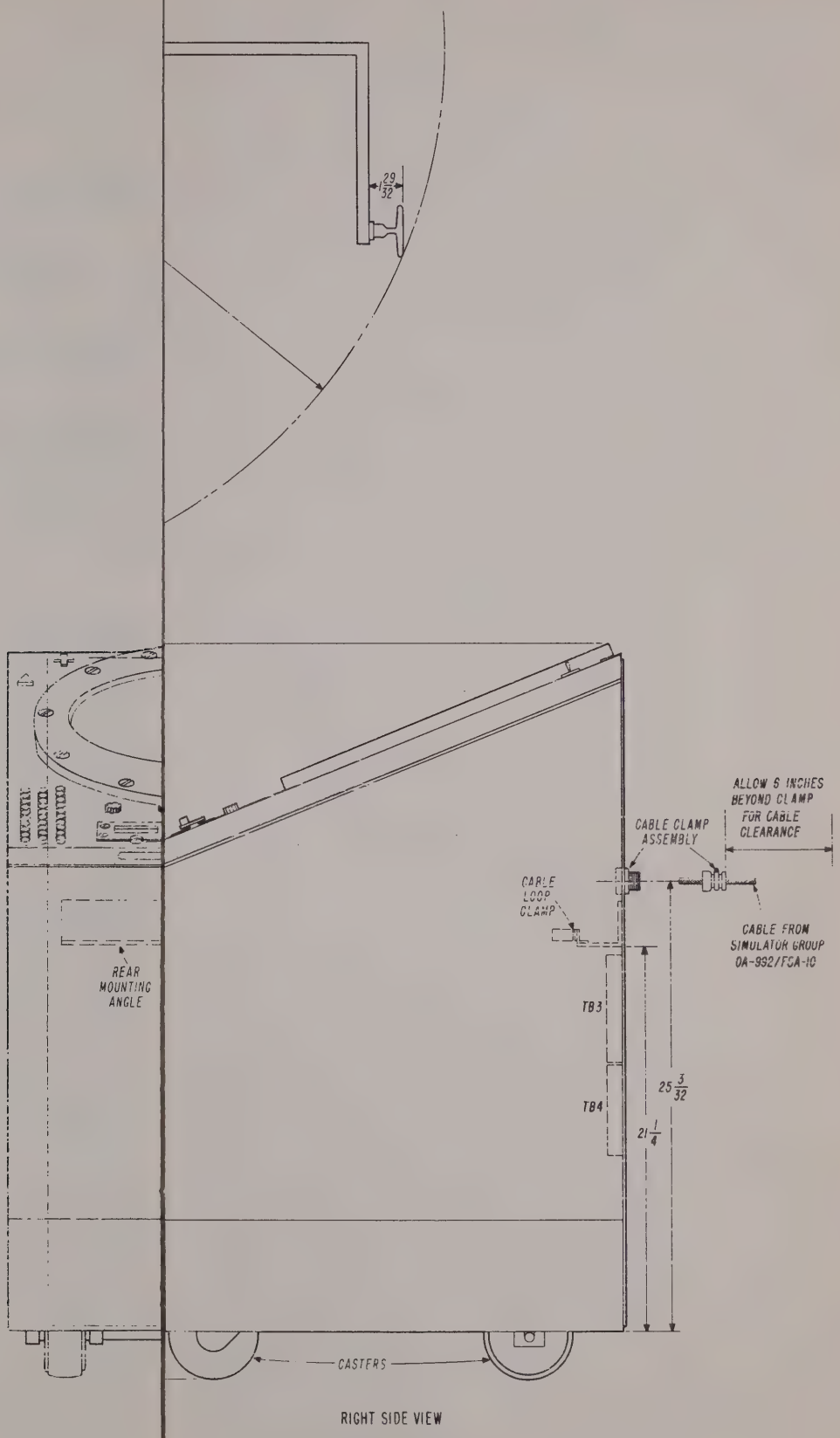

MOUNTING HOLES-4 DIA FOR 3/4 DIA BOLTS
CABLE ENTRANCE PLATES
CABINET GROUND 2 FEET OF GROUND STRAP SUPPLIED CONNECT ARMOR BRAID OF CABLE IN HOLE 15
BOTTOM VIEW

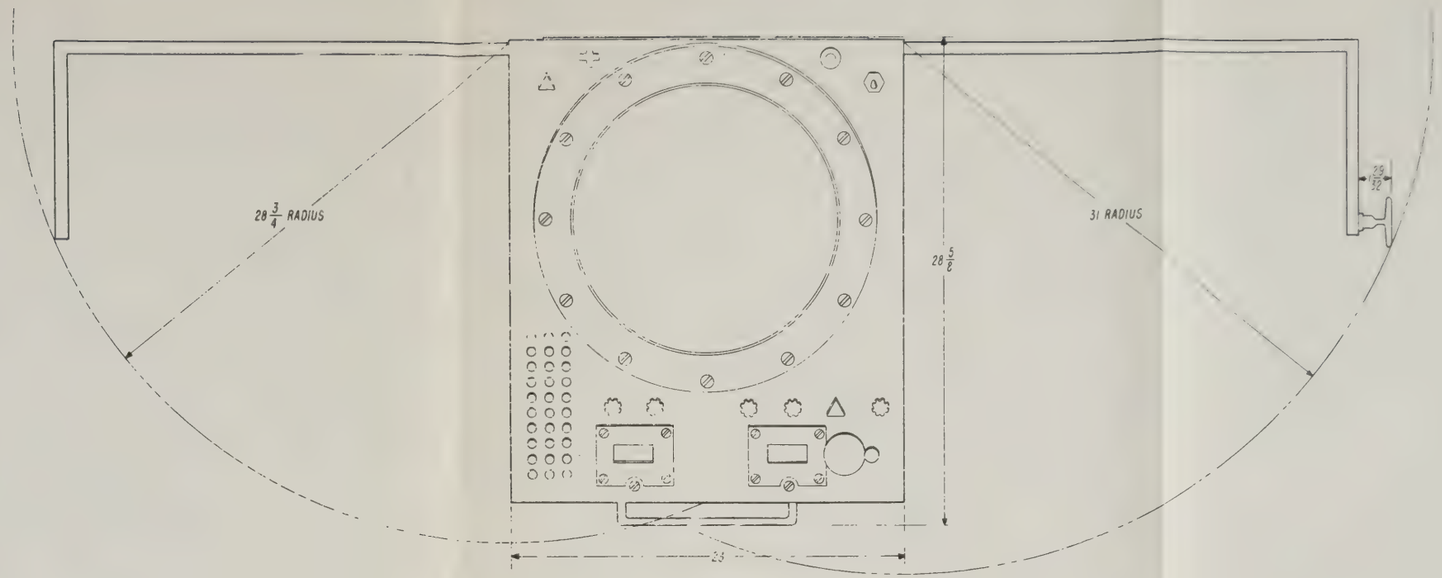
Figure 3-4. Television Camera Group OA-991/FSA-10, Mounting and Installation Details



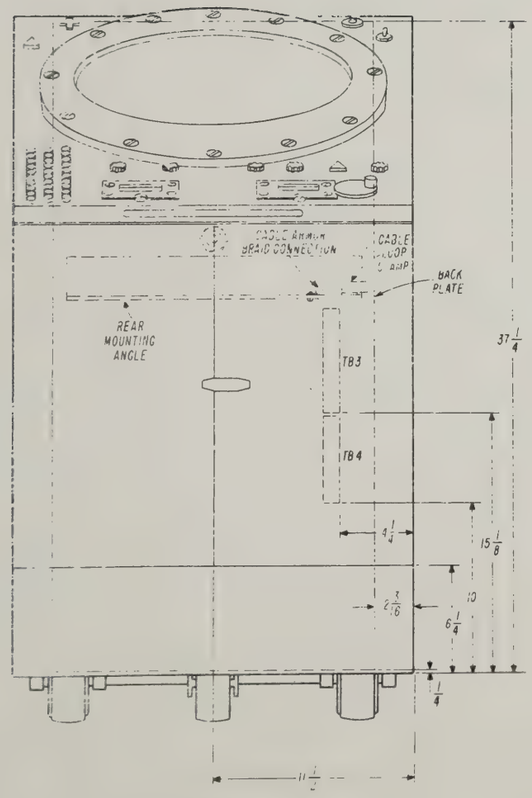
RIGHT SIDE VIEW

dicator IP-346/FSA-10, Mounting and Installation Details

T.O. No. 31S1-2FSA10-5

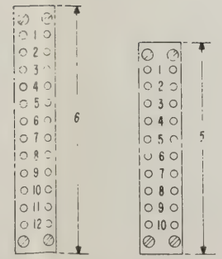


TOP VIEW

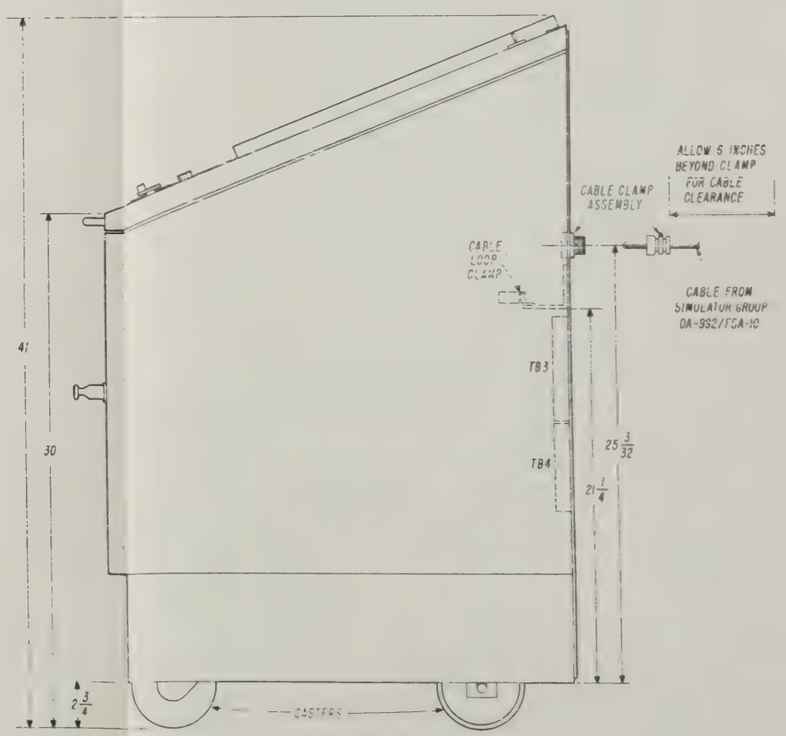


FRONT VIEW

NOTES.
ALL DIMENSIONS ARE IN INCHES.



TERMINAL BOARDS USED DURING INSTALLATION FOR LOCATION OF TERMINAL BOARDS SEE FRONT AND RIGHT SIDE VIEW



RIGHT SIDE VIEW

Figure 3-5. Azimuth and Range Indicator IP-346/FSA-10, Mounting and Installation Details

SECTION IV

INSTALLATION INSTRUCTIONS

4-1. MANPOWER REQUIREMENTS.

4-2. GENERAL.

4-3. Table VIII lists the manpower required for installation of Television Converter-Display Group AN/FSA-10.

4-4. TEST EQUIPMENT AND TOOLS REQUIRED.

4-5. Table IX lists the test equipment normally required for installation of Television Converter-Display Group AN/FSA-10. Reference should be made to the technical orders (T.O.'s) or instruction books accompanying each item of test equipment. No special tools are required for installation of Television Converter-Display Group AN/FSA-10. A tool kit equipped with open-end wrenches, screwdrivers, a drill set, a wire stripping tool, a solder gun, pliers, a wire cutter, an insulated tube puller and a 16 x 24-inch steel square should be available.

For a complete description of the use of the test equipments, refer to the accompanying technical orders (T.O.'s) or instruction books.

TABLE VIII
MANPOWER REQUIRED FOR INSTALLATION

TYPE AND LEVEL OF SKILL	MANHOUR REQUIREMENTS
Six men to handle crates, uncrate and lift units into place. Unskilled.	48
Four men to wire up units, and to perform pre-operational adjustments and alignment checks. Technicians trained in initial installation and check-out procedure.	160
Three men to prepare the mounting surface including floor cable trenches and drilling of mounting holes. Construction personnel perform this work.	Variable depending on cable trench construction.

TABLE IX
TEST EQUIPMENT REQUIRED FOR INSTALLATION

NAME	AN TYPE NO. OR MFR. MOD. NO.	REMARKS
Multimeter	TS-389/U	or equivalent
Oscilloscope	OS-48	or equivalent
Pulse Generator	AN/UPM-15	or equivalent
Multimeter	ME-26/U	or equivalent
Electron Tube Test Set	TV-7/U	or equivalent
Electrostatic Voltmeter	Sensitive Research Corp., Model ESH	Range one to 20 KV

4-6. LOCATING AND MOUNTING COMPONENTS.

4-7. All major units of Television Converter-Display Group AN/FSA-10 are shipped with the assemblies installed in the cabinets and connected to the cabinet terminal boards. Each crate containing components of Television Converter-Display Group AN/FSA-10 should be inspected for damage before it is opened. Where damage appears, the crate should be opened in the presence of responsible witnesses in order that a properly supported claim can be submitted in case the contents are damaged.

4-8. A packing list in an envelope accompanies each crate. Do not uncrate any of the equipment until a packing list has been obtained, since the shipment must first be checked against this list. The packing list shows the number of boxes in the shipment. This list should be checked to insure that the shipment is complete. In addition, when the crates have been opened, check the contents of each crate against the packing list. If anything is missing, a properly substantiated report should be made to the proper authorities.

4-9. All crates have been prominently marked to indicate which side should be up. If a crate has accidentally been placed in some other position, the crate should be returned to its proper position before it is opened. Due to the weight and bulk of some crates, materials handling equipment (such as a fork lift) is required. Tools required to open the crates include a small crowbar, a nail puller and a 12-inch screwdriver. The top of the crate should be removed first and the interior then examined to see which side of the crate should be removed next. After the components and material have been uncrated, they should be examined carefully for damage. All assemblies should be inspected for broken tubes. Remove all packing material from the interior of the cabinets and install the rear doors on the cabinets.

WARNING

Until Decoder Group OA-993/FSA-10 and Simulator Group OA-992/FSA-10 have been bolted in place, there is danger of tipping them over.

4-10. Figure 3-1 in Section III is a typical layout diagram for Television Converter-Display Group AN/FSA-10. When the building which is to shelter Television Converter-Display Group AN/FSA-10 has been selected, the floor must be prepared for mounting the components. Decoder Group OA-993/FSA-10, Simulator Group OA-992/FSA-10 and Television Camera Group OA-991/FSA-10 are each mounted by four ½-inch bolts, four inches in length. The mounting surface should be prepared as follows:

a. Mark on the floor with chalk an outline of each component as the equipment will be laid out using the outline dimensions shown in figures 3-2 through 3-5 of Section III. Insure that sufficient clearance exists in the front and rear of the equipment to allow opening of the cabinet doors. Allow ½-inch between Decoder Group(s) OA-993/FSA-10 and Simulator Group OA-992/FSA-10 cabinets for protruding hardware.

b. Provide cable trenches in the floor to house the cables which interconnect components and connect Television Converter-Display Group AN/FSA-10 with external equipments at the central-radar site. The dimensions of these trenches should be 12 inches in width by eight inches in depth arranged as shown in figure 3-1 of Section III. If a straight wall cable trench (no cutouts) is used, the cabinet fronts should overlap the side of the trench approximately six inches.

c. Mark the location of the mounting holes for drilling, using the dimensions shown in figures 3-2 through 3-4 of Section III. When the mounting holes have been drilled and the floor cable trenches have been completed, lay out the interconnecting cables in the trenches with the connector ends lined up for running into the units of Television Converter-Display Group AN/FSA-10. Do not connect the unterminated ends of wires in the cables which connect to external equipment until after Television Converter-Display Group AN/FSA-10 is interconnected.

4-11. The a-c power cables must be connected to the line filters on the bottom of Simulator Group OA-992/FSA-10 before this unit is bolted to the floor. Paragraph 4-23 provides the details for fabrication of these cables. When the mounting surface has been prepared, lift each of the major components of Television Converter-Display Group AN/FSA-10 into place and install the mounting bolts. Fasten each unit securely in place.

4-12. Television Camera Group OA-991/FSA-10 is shipped in sections, as listed in Table III. When the lower section has been mounted to the floor, straighten out the cables that have been placed in the top of the lower section. These cables are used to interconnect the sections of Television Camera Group OA-991/FSA-10. Place the free ends of the cables out of the way in preparation for mounting Television Camera Support MT-1612/FSA-10. Figure 3-4 in Section III shows the locations of the cable grommets in the top of the lower section. Refer to figure 3-4 and install the shockmounts for Television Camera Support MT-1612/FSA-10. Place Television Camera Support MT-1612/FSA-10 on its shock mountings and bolt it in place. Refer to figure 3-4 and install the parts on Television Camera Support MT-1612/FSA-10 as follows:

Note

Do not for *any* reason change the mounting orientation of the mirror support bracket by loosening its mounting screws. This support has been carefully oriented at the factory and should not require any adjustment in the field.

a. Place Television Camera PH-710/FSA-10 on its adjustable stand and bolt it in place with its four mounting screws and lockwashers. Connect the air duct, figure 3-4, to the air inlet fitting on the right side of Television Camera PH-710/FSA-10 and tighten the clamp.

b. To insert the camera tube, type 6198 (which is shipped separately), first remove the lens mount from Television Camera PH-710/FSA-10. Wipe the dust and fingerprints from the face of the tube using lens tissue. Remove the coverplate from the left side of Television Camera PH-710/FSA-10 after removing its mounting screws. Push the tube in from the front of the assembly until the tube face is approximately $\frac{1}{32}$ inch inside the front surface of the focus coil thus ensuring a good contact in the retaining springs and with the signal electrode. Orient the tube so that the short index base pin is to the right (as viewed from the base end of the tube). Hold the tube in the proper position; and push the inside coil (deflection) as far forward as possible without pushing the tube out of place. Make sure the marker on the rear coil flange is approximately horizontal on the right side as viewed from the rear. Tighten the rear support ring to hold the coil in place. Rewipe the tube face and install the lens mount. Install the camera tube socket; and replace the coverplate.

WARNING

Use gloves and goggles when handling the cathode ray tubes. Always firmly support the PPI tubes during installation.

c. To install the three-inch cathode ray tubes V1505, V1506, V1507, V1508, V1509, and V1510, type 3ACP7, first make sure the tubes are properly installed in the PPI tube shields. Install the support shank in the tube-support arm and tighten the large knurled knob. The face of the cathode ray tube should touch the map mask. Loosen the shield clamp and rotate the tube and shield assembly so that pins 5 and 12 are in a plane parallel to the base of Television Camera Support MT-1612/FSA-10. Orient the tubes in PPI cluster A (V1505, V1506, and V1507) so that pin 5 is to the left as viewed from the rear of the tube. Orient the tubes in PPI cluster B (V1508, V1509, V1510) so that pin 5 is to the right as viewed from the rear of the tube. Use a square to make this adjustment as accurate as possible. Tighten the shield clamp to line up the north-south, east-west deflection plates, approximately. Carry out the preceding procedure for all six tubes. After the tubes have been installed, check the pin alignment of each PPI tube.

CAUTION

Do not handle the faces of the mirror.

d. Install the 11-inch mirror on the mirror support bracket, with the silvered side facing the camera, and fasten in place with the five mounting screws.

e. Connect the tube socket of the associated cable to the base of each three-inch cathode ray tube. Grommets 1, 2, 3, 4, 5, 6 protect the cable for V1506, V1508, V1505, V1509, V1507, and V1510 respectively. Attach the high voltage cables to each tube as marked. Group the cables connected to XV1505, XV1506 and XV1507 and secure them to the base of Television Camera Support MT-1612/FSA-10 with the two cable clamps near the rear of the base. Group the cables connected to XV1508, XV1509 and XV1510 and secure them to the base with the cable clamp closest to the right front corner of the cabinet. Attach the mask-lighting fanning strip E301 to terminal board TB1501 (figure 3-4) and install the terminal board cover.

4-13. When all of the parts are mounted on Television Camera Support MT-1612/FSA-10, place terminal boards TB317 and TB318 (mounted on a plate) and the attaching cables on Television Camera Support MT-1612/FSA-10. Lift the top cover for Television Camera Group OA-991/FSA-10 into place on the lower section and install the six $\frac{1}{2}$-inch mounting bolts provided. Terminal boards TB317 and TB318 are mounted on a plate and located as shown in figure 3-4. The plate mounting bolts and standoffs are shipped installed in the mounting holes on the top cover of Television Camera Group OA-991/FSA-10. Mount the plate on the standoffs and secure the plate with the mounting bolts. Connect fanning strip E1517 to TB317 and fanning strip E1518 to TB318. Install the terminal board covers for TB317 and TB318.

4-14. Install tubes V2401 and V2407, type 25T, in Power Supply PP-1385/FSA-10 located in Television Camera Group OA-991/FSA-10. Open the rear door and remove the hood from Power Supply PP-1385/FSA-10 to gain access for installing these tubes. Replace the hood after the tubes have been installed. Make sure the caps are connected to the respective tubes.

4-15. Connect leads A and B at transformers T2501 and T2502 in Power Supply PP-1384/FSA-10 in accordance with the following table, depending upon the number of channels being used in Television Converter-Display Group AN/FSA-10.

CONNECT LEAD	NUMBER OF CHANNELS USED		
	1, 2	3, 4	5, 6
	TO TERMINAL		
A	4	5	6
B	9	8	7

4-16. Install tubes V2301 and V2302, type 836, in Power Supply PP-1387/FSA-10. Make sure that the caps are connected to their respective tubes.

4-17. Install the cable boom in the top of Simulator Group OA-992/FSA-10. Special Purpose Electrical Cable Assembly CX-3771/U that interconnects Simulator Group OA-992/FSA-10 to Azimuth and Range Indicator IP-346/FSA-10 is installed in the cable boom and fabricated at the factory. The bearing housing is fastened to the top of Simulator Group OA-992/FSA-10 cabinet by five ¼-inch bolts. Place the pivoting end of the boom in the bearing housing so that its shoulder fits against the collar on the bearing housing. Place the retaining ring on the boom to fasten it to the bearing housing. Adjust the cable so that approximately 80 inches of cable extends from the open end of the boom to the harness that fits on the terminal boards in Azimuth and Range Indicator IP-346/FSA-10. Screw a cable clamp assembly on both ends of the boom. At the Azimuth and Range Indicator IP-346/FSA-10 end of the cable, place the cable clamp assembly on the cable as shown in figure 3-5 of Section III. Run the cable harness through the cable-loop clamp on the rear mounting-angle of Azimuth and Range Indicator IP-346/FSA-10. Fan the cable harness out and connect it to terminal boards TB3 and TB4 as shown in figure 4-14. Make the cable-armor braid connection to the lug connection on the rear mounting angle and tighten the cable-loop clamp. Assemble the cable clamp assembly on the back of Azimuth and Range Indicator IP-346/FSA-10 and tighten the clamp. In Simulator Group OA-992/FSA-10 run the cable through the grommet shown in figure 3-3 and connect the cable harness as shown in figure 4-14. Fasten the cable to Electrical Equipment Cabinet CY-1970/FSA-10, as shown in figure 3-3, by means of the cable loop clamps that are installed extending from the cable boom to the right side of the cabinet and down the right side rear to terminal board TB414. Do not subject the boom cable to sharp bends. Tighten the cable clamp on both ends of the boom. See that the boom rotates freely in the bearing housing. Make similar cable-

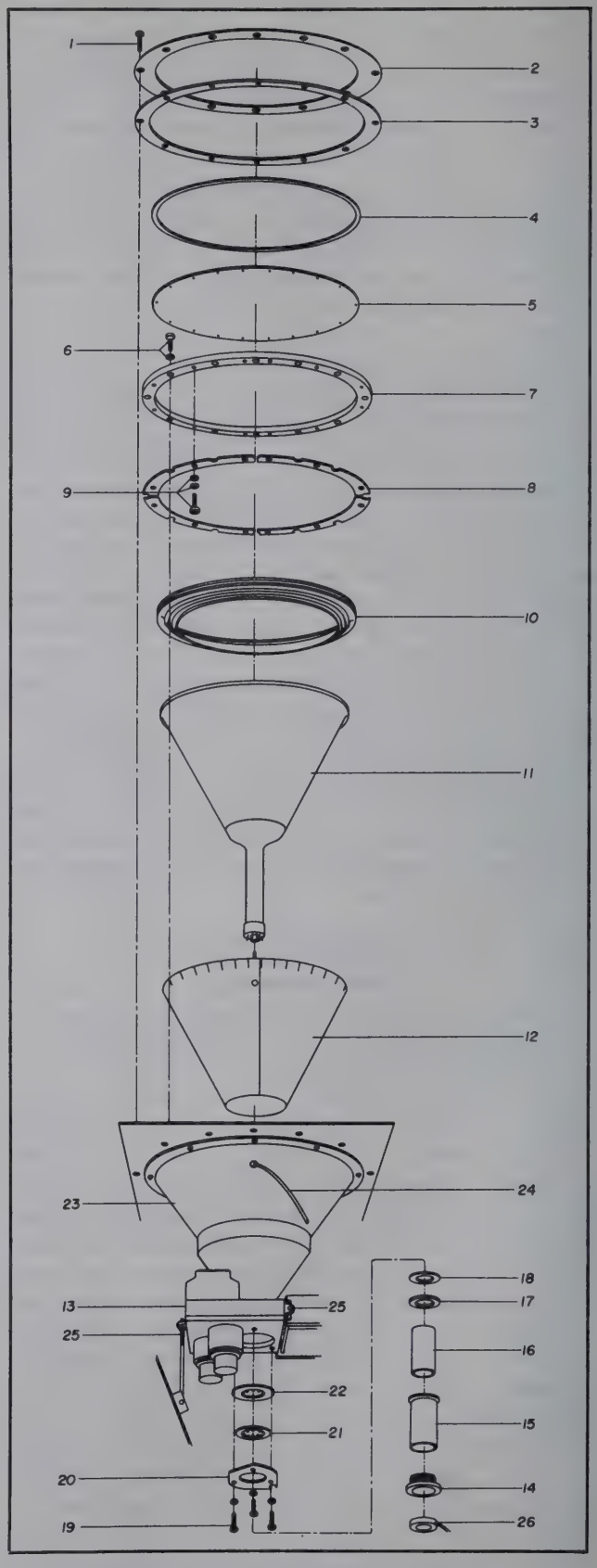


Figure 4-1. Azimuth and Range Indicator IP-346/FSA-10, PPI Tube Installation

armor braid and ground connections to the fuse panel mounting screw, shown in figure 3-3, and to a bolt of the bearing housing where the cable enters the cabinet.

4-17A. Install two Electrical Synchronizer SN-166/FSA-10 components in Decoder Group OA-993/FSA-10 located as shown in figure 3-2 and one Electrical Synchronizer SN-166/FSA-10 in Simulator Group OA-992/FSA-10 located as shown in figure 3-3. The components are mounted in the rack by screws through slots in the right and left ends of the front panel. The interconnection terminal boards are located directly to the left and right of the component front panel in the cabinet. Remove the terminal board covers and connect fanning strips E707 and E708 to the mating terminal boards. E707 on the upper Electrical Synchronizer SN-166/FSA-10 located in Decoder Group OA-993/FSA-10 connects to TB203 and E708 connects to TB204. On the lower component E707 connects to TB213 and E708 connects to TB212. See figure 3-2. In Simulator Group OA-992/FSA-10, E707 connects to TB403 and E708 connects to TB404. Replace the terminal board covers.

CAUTION

For Electrical Synchronizer SN-166A/FSA-10 only. The speed reducer on the resolver drive assembly must not be run without first adding the lubricant packed inside the chassis. See the lubrication chart on the chassis door.

4-18. Make all cabinet grounding connections electrically integral with the external ground bus. The ground connections in each cabinet are shown in figures 3-2 through 3-4 in Section III. Remove the air outlet screen covers from the cabinets. Store the cover for Electrical Equipment Cabinets CY-1970/FSA-10 and CY-1971/FSA-10 on the rear door of each cabinet. There are four covers on Electrical Equipment Cabinet CY-1969/FSA-10. Store the two side covers on the front doors and the two rear covers above the blower housing.

4-19. Refer to figure 4-1 and install the PPI cathode ray tube in Azimuth and Range Indicator IP-346/FSA-10 as follows:

a. Remove 12 screws (1) from bezel (2) and remove the bezel, gaskets (3) and (4) and window (5).

b. Remove 12 screws and lockwashers (6) attaching window retaining ring (7) to the bezel mounting ring and remove the window retaining ring (7). Tube mounting ring (8) is attached to the window retaining ring by 12 screws, washers and lockwashers (9).

c. Remove the four segments of tube mounting ring (8) from window retaining ring (7).

WARNING

Use gloves and goggles when handling the PPI tube. Always firmly support the PPI tube during installation.

d. The mounting and insulation ring (10) and insulation sleeving (12) may be installed on the cathode ray tube at the factory. If not, install these parts first on the PPI tube. Place insulation sleeving (12) on the tube so that it fits snugly and fit insulation ring (10) around the edge of the PPI tube face. See that the lower lip of the insulation ring holds the insulation sleeving in place. Place each segment of tube mounting ring (8) on mounting and insulation ring (10) and attach it to window retaining ring (7) with the 12 screws, washers and lockwashers (9).

e. Before placing the PPI tube in Azimuth and Range Indicator IP-346/FSA-10, certain parts must be removed from the yoke drive-gearing assembly (13). Unscrew sleeve (14) and remove shield holder (15), shield (16), washer (17) and backing washer (18). It should not be necessary to remove centering magnets (21) and (22) to install the PPI tube. Care must be exercised when placing the neck of the tube through the centering magnets to ensure that the centering magnet contacts are not broken. If it is desired to remove the centering magnets, remove three screws (19), adapter (20) and centering magnets (21) and (22).

f. Carefully place the PPI tube in Azimuth and Range Indicator IP-346/FSA-10. Make sure that the high-voltage contact on the PPI tube is lined up with the high-voltage cable (24) hole in the upper tube shield (23).

CAUTION

Insure that the neck of the PPI tube is lined up properly in the yoke drive-gearing assembly. The nuts on tube support rods (25) may be adjusted to align the yoke drive-gearing assembly so that the tube fits in place properly.

g. Install 12 screws and lockwashers (6).

h. Install window (5), gaskets (3) and (4) and bezel (2). Fasten in place with 12 screws (1).

i. Perform the reverse of step e. Make sure that sleeve (14) is screwed in adapter (20) just enough for washer (17) to hold the PPI tube firmly in place.

j. Connect tube socket (26) to the base of the PPI tube and attach high voltage cable (24) to the connector on the PPI tube.

4-19A. Open the doors of Azimuth and Range Indicator IP-346/FSA-10 and install the range strobe chassis, shown in figure 4-13, as follows:

a. Remove the two control knobs and crystal, type CR-46/U, from the top of the range strobe chassis.

b. Place the range strobe chassis in its position in Azimuth and Range Indicator IP-346/FSA-10. Make sure the range strobe pushbuttons fit properly in the holes in the front panel of Azimuth and Range Indicator IP-346/FSA-10.

c. Secure the range strobe chassis to Azimuth and Range Indicator IP-346/FSA-10 with the four range strobe fasteners shown in figure 4-13.

d. Install the knobs on RANGE MK. GAIN control R192 and STROBE GAIN control R191.

CAUTION

Do not remove the plastic caps from the counter tubes. Do not allow the counter tubes to come into close contact with ferrous metals. Handle the tubes with care. Before installing the tubes straighten the pins in the pin straightener which is mounted on the front of the range strobe chassis.

e. Install the three counter tubes in their sockets on the range strobe chassis.

f. Connect the leads to terminal boards TB1 and TB2 located on the bottom of the range strobe chassis, in accordance with the following table.

CONNECT LEAD	TO TERMINAL	NEXT CONNECTION
12	TB1-1	TB8-8
11	TB1-2	TB8-9
14	TB1-3	TB8-12
13	TB1-4	TB8-13
16	TB1-5	TB8-10
15	TB1-6	TB8-11
17	TB1-7	TB9-10
18	TB1-8	TB9-12
1	TB2-1	TB9-9
2	TB2-2	TB9-8
3	TB2-3	TB8-6
6, 4	TB2-4	Ground
5	TB2-5	TB8-2
7	TB2-6	TB8-3
10, 8	TB2-7	Ground
9	TB2-8	TB8-5
19	TB2-9	TB8-1

4-19B. Install the high voltage power supply in Azimuth and Range Indicator IP-346/FSA-10. See figure 4-13. The high voltage power supply is secured to the bottom of the cabinet by four nuts and washers. Connect the leads to the high voltage power supply in accordance with the following table.

CONNECT LEAD	TO TERMINAL	NEXT CONNECTION
104 and 105	FIL PRI	S3002-2 and R3048
106	COM PRI	TB11-1
107	HV PRI	K3001
HV Connector	CASE COMM	V142

4-20. Remove the cover from the range strobe chassis. Locate printed circuit board E1 on the front of the range strobe chassis. Make sure that the proper crystal is installed in its holder on printed circuit board E1, depending on the desired range of operation. For a 100-mile range, use crystal type CR-18/U, 809.330 kc. For a 150-mile range use crystal type CR-46/U, 539.533 kc. Both crystals are provided with the equipment.

4-21. INTERCOMPONENT CABLING FABRICATION.

4-22. The cables and fittings required to interconnect the components of Television Converter-Display Group AN/FSA-10 are supplied prefabricated. The cables are terminated in terminal lugs and are harnessed to fit on the terminal boards to which they connect. Figure 4-14 is an interconnection diagram showing the terminal board connections for the interconnecting cables. Table IV of Section II lists the cable assemblies furnished for installation of Television Converter-Display Group AN/FSA-10. Figures 3-2 through 3-5 in Section III show the locations of all terminal boards and cable entry plates provided for interconnection of the components of Television Converter-Display Group AN/FSA-10.

4-23. EXTERNAL CABLING FABRICATION.

4-24. Inputs to Television Converter-Display Group AN/FSA-10 are received from the telephone lines, the power source and the central radar. Telephone line connections are made direct to the equipment. The cables for the remaining inputs are supplied with the equipment and are terminated in terminal lugs at the Television Converter-Display Group AN/FSA-10 end. The connectors for connection to the central radar are supplied for field installation after the cable has been trimmed. The Television Converter-Display Group AN/FSA-10 end of the cables should be connected first. Then after the cable has been fitted to the central radar, the connectors should be installed on their respective cables according to the procedures described in the following paragraphs. Line filters FL401-FL403 are located on the bottom of Simulator Group OA-992/FSA-10 as shown in figure 3-3 of Section III. Therefore, the a-c power cables must be connected as shown in figure 4-14 before the cabinet is bolted to the floor. Since there is not enough space between the floor and the bottom of the cabinet to permit access to these connections, the cabinet must be tilted back while the a-c power cables are being connected to the line filters. The installing activity must supply the connectors for the power-source end

of the power cables. The coaxial cable which connects the remote-radar video output from Television Converter-Display Group AN/FSA-10 to a central-radar indicator is installed in the same manner as the coaxial cables connecting to the central radar. Table IV of Section II lists the external cable assemblies furnished with Television Converter-Display Group AN/FSA-10. Table X lists the input and output signals with their terminal connections at Television Converter-Display Group AN/FSA-10.

4-24A. Terminating resistors are provided in Electrical Equipment Cabinets CY-1969/FSA-10 and CY-1970/FSA-10 for continuation of 10-degree angle marks, central-radar trigger and video. To continue the signal on 50 ohm line disconnect the 47 ohm resistor and connect the line to the ungrounded end of the 47 ohm resistor. To continue the signal on 72 ohm line, disconnect the 47 ohm resistor and connect the line to the open end of the 22 ohm resistor. The resistor assemblies are mounted on terminal board TB414 (10-degree angle marks) in Electrical Equipment Cabinet CY-1970/FSA-10 and on terminal boards TB304 (trigger) and TB305 (video) in Electrical Equipment Cabinet CY-1969/FSA-10.

TABLE X
INPUT AND OUTPUT SIGNALS, TERMINAL INFORMATION

INPUT	CONNECTION
Phone Line Channel 1A	TB407-1 and 2
Phone Line Channel 1B	TB407-6 and 7
Phone Line Channel 2A	TB407-11 and 12
Phone Line Channel 2B	TB407-16 and 17
Phone Line Channel 3A	TB409-1 and 2
Phone Line Channel 3B	TB409-6 and 7
Three-Phase Power Cable	
Phase A	FL401
Phase B	FL402
Phase C	FL403
Neutral Return Cable	Cabinet ground in Electrical Equipment Cabinet CY-1970/FSA-10
Inputs from the Central Radar as follows:	
One-Speed Synchro Data	
S1	TB414-6
S2	TB414-7
S3	TB414-8
36-Speed Synchro Data	
S1	TB414-4
S2	TB414-3
S3	TB414-5
Synchro Reference Voltage	
Phase 1	TB414-2
Phase 2	TB414-1
30-Degree Angle Marks	TB414-15

TABLE X—Concluded

INPUT	CONNECTION
Video	TB414-9
Trigger	TB414-16
10-Degree Angle Marks	TB414-20
OUTPUT	**CONNECTION**
Remote-Radar Video	TB308-1

4-25. To connect Radio Frequency Power Cable Assembly CG-1463/U to connector UG-260B/U, refer to figure 4-2 and proceed as follows:

a. Cut off the end of the cable square and neat.

b. Cut off the outer jacket 5/16-inch from the end of the cable exposing the braid as shown in A. Take care not to nick the braid.

c. Fray the shield and strip the inner dielectric 1/8-inch from the end of the cable as shown in B.

d. Tin the conductor. Taper the braid and slide the clamp nut, washer, gasket and clamp over the braid as shown in C.

e. The clamp should be placed so that its inner shoulder fits squarely against the end of the cable jacket. With the clamp in place, comb out the braid and fold it back and butt the gasket and washer against the clamp as shown in D.

f. Trim the braid 3/32-inch from the end. Slip the contact into place, butt it against the dielectric as shown in E and solder. Make sure the cable dielectric

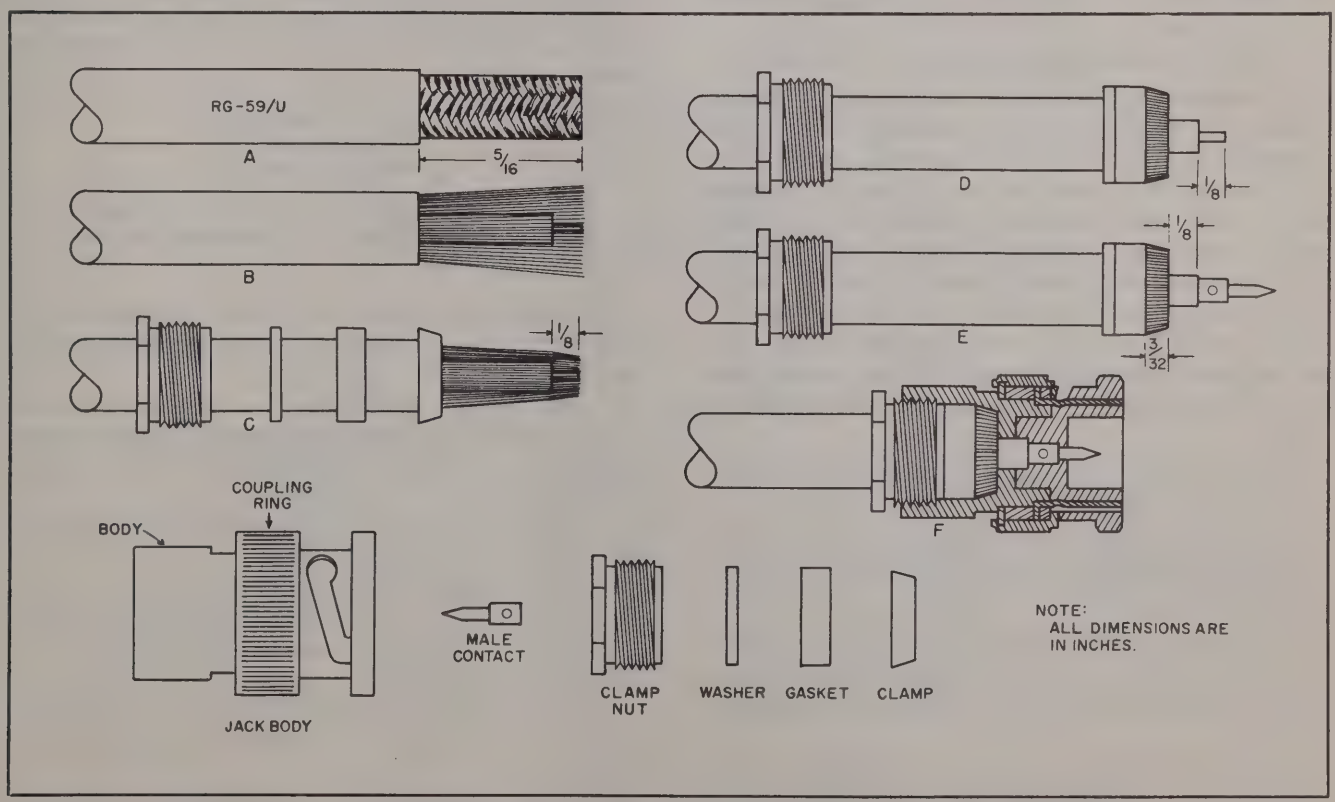


Figure 4-2. Fabrication of Radio Frequency Power Cable Assembly CG-1463/U

is not heated excessively, thereby causing swelling and preventing it from entering the connector body. Remove the excess solder from the outside of the contact.

g. Push the assembly into the jack body as far as it will go as shown in F. Slide the clamp nut into the body and screw it into place with a wrench until tight. Hold the cable and shell while rotating the clamp nut.

4-26. To connect Special Purpose Electrical Cable Assembly CX-3772/U to the 20-pin connector, refer to figure 4-3 and proceed as follows:

a. Make sure that all parts are clean and free of oil, grease, and dirt.

b. Cut off the end of the cable square and neat.

c. Slide the clamp shell, large force ring, pressure gasket, small force ring, backing washer, and assembly holder onto the cable as shown in A.

d. Strip the cable sheath one inch from the end of the cable as shown in B. Strip back the insulation 0.25 inch from the end of each conductor. Twist and tin the conductors taking care not to use excessive heat.

e. Place the seal gasket in its proper position as shown in C. Place the cap washer on the connector shell.

f. See figure 4-14 for the color code of the conductor-connections to the lettered pins of the connector. Be sure that the conductors are connected to the proper lettered pin in carrying out the following procedure. Start with contact A and work around counterclockwise in soldering the conductors to their respective contacts.

g. Apply rosin base flux and heat to the solder well A, by means of a soldering iron, until the solder begins to melt. Be sure to apply the soldering iron to the open side of the solder well to prevent solder from collecting on the outside of the contact. Continue heating the contact and start sliding the conductor into the solder well to allow the conductor to heat up, thus preventing cold solder joints. When the solder is completely melted push the conductor all the way into the solder well. Remove the soldering iron and hold the conductor in alignment with the contact until the solder solidifies. Remove the excess flux from the contact.

h. Carry out the preceding procedure for all nine conductors.

i. Hold the conductors taut and properly aligned, and slide the assembly holder against the edge of the connector.

j. Slide the backing washer, small force ring, pressure gasket, and the large force ring into the assembly holder. Make sure that the parts are placed squarely in position.

k. Slide the clamp shell over the assembly holder, hold the cable stationary, and screw the clamp shell on the connector as shown in D.

l. Tighten the clamp shell securely with a standard strap wrench. Make sure that during any of these procedures the cable is not twisted.

m. Keep the cap on the connector until connection is made to the central-radar jack.

4-27. PRE-OPERATIONAL CHECKS AND MINOR ADJUSTMENTS.

4-28. The following checks should be made prior to energizing Television Converter-Display Group AN/FSA-10:

a. Check to see that all front panel ON-OFF switches are in the OFF position.

b. Check all interconnecting and external cables for proper connections.

c. Check to see that the two high voltage rectifier tubes V2301 and V2302, type 836, are properly installed in Power Supply PP-1387/FSA-10.

d. Check to see that the two voltage regulator tubes, V2401 and V2407, type 25T, are properly installed in Power Supply PP-1385/FSA-10.

e. Check to see that the three-inch PPI tubes are installed in their holders with pins 5 and 12 in a horizontal position with pin 5 to the right for PPI cluster B and to the left for PPI cluster A as viewed from the rear of each tube.

f. Check all assemblies for damaged parts or loose connections.

g. In Electrical Synchronizer SN-166/FSA-10 check to see that the brake disc and the magnet arm rotate freely in a clockwise direction as viewed from the resolver end.

CAUTION

Do not turn the output shaft of the reduction gear by hand. Damage to the reduction gear may result.

h. Check to see that the central radar set is operating with its antenna turning at a rate between three and seven rpm.

i. Check to see that leads A and B at transformers T2501 and T2502 in Power Supply PP-1384/FSA-10 are connected in accordance with the table in paragraph 4-15.

j. See that the surfaces of the map masks touch the faces of the three-inch PPI tubes.

k. With a square, check the north scribe on mask B to make sure that it is vertical with respect to the base of Television Camera Support MT-1612/FSA-10.

l. Check to see that the proper crystal is installed in its holder on printed circuit board E1 of Azimuth and Range Indicator IP-346/FSA-10 as outlined in paragraph 4-20.

m. Check to see that the coaxial cable is connected between VIDEO OUTPUT J1501 on Television

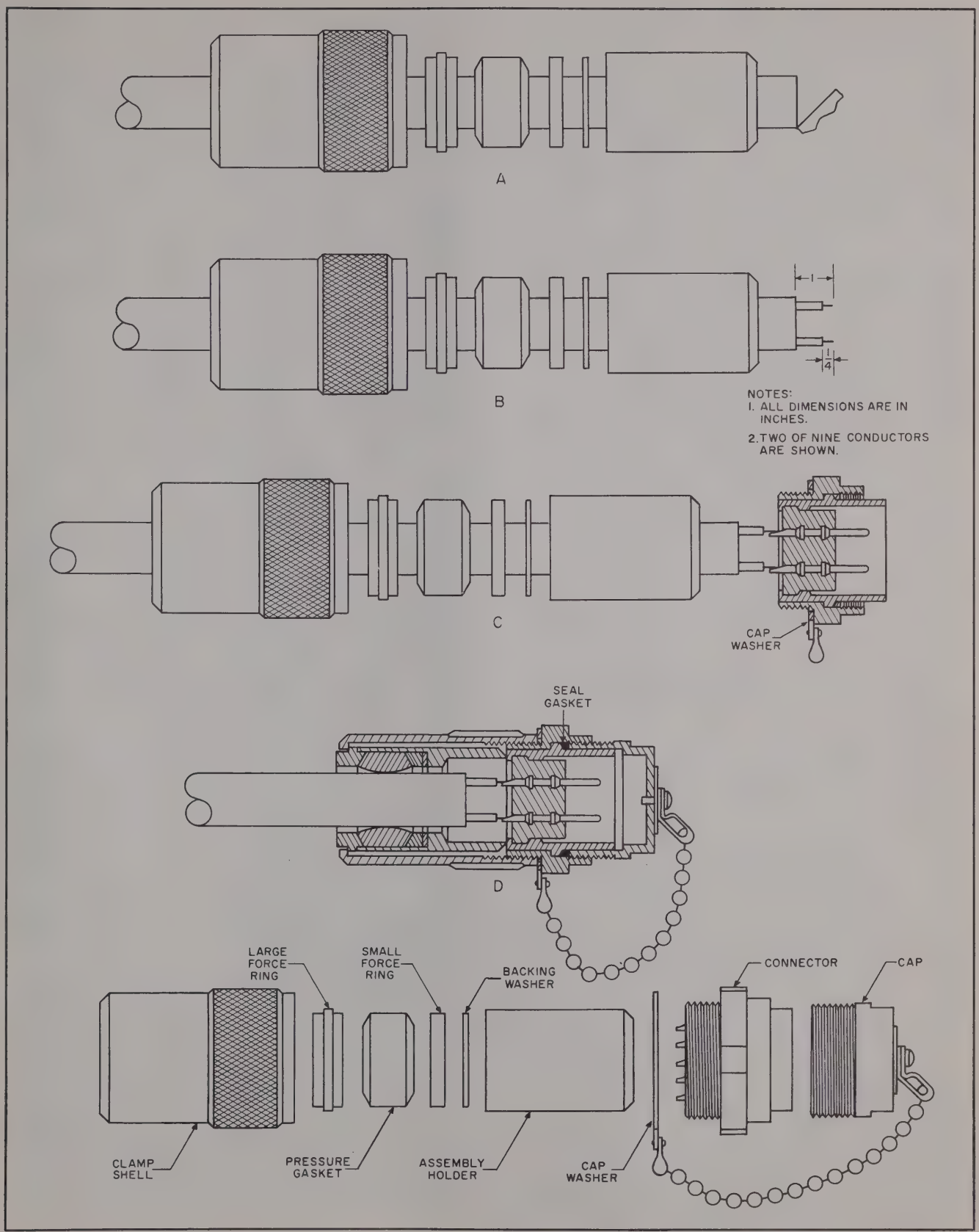


Figure 4-3. Fabrication of Special Purpose Electrical Cable Assembly CX-3772/U

Camera PH-710/FSA-10 and REMOTE VIDEO INPUT J1701 on Video Amplifier AM-1356/FSA-10.

n. Check to see that the yoke coil in Television Camera PH-710/FSA-10 is positioned with the R symbol on the rear flange face approximately horizontal and on the righthand side, as viewed from the rear.

o. Check to see that the air outlet screen covers for each cabinet have been removed.

4-29. STARTING PROCEDURE.

4-30. The components located in the upper half of Decoder Group OA-993/FSA-10 are connected in channel A and those located in the lower half are connected in channel B. If any component fails to energize, refer to Section V in the Handbook Service Instructions and carry out the troubleshooting procedure therein. Proceed to start as follows:

a. Close the power-source circuit breakers to provide power to Simulator Group OA-992/FSA-10.

b. Refer to figure 4-4 and make sure that MAIN POWER circuit breaker CB2701 is in the OFF position. Remove all fuses from their holders on the Fuse Panel. Place MAIN POWER circuit breaker CB2701, located on the fuse panel, in its ON position. Each of the fuse indicator lights should light.

c. Place MAIN POWER circuit breaker CB2701 in its OFF position. Replace the fuses in their proper holders in the Fuse Panel.

d. Place MAIN POWER circuit breaker CB2701 in its ON position.

e. Check that the blowers in Decoder Group OA-993/FSA-10, Simulator Group OA-992/FSA-10, and Television Camera Group OA-991/FSA-10 are running.

f. Place FILAMENTS switch S2003 in Radar Signal Simulator SM-86/FSA-10 in the ON position. See figure 4-4. The chassis are coded in figure 4-4 in the following manner:

Code	*Chassis*
A	Video Decoder KY-188/FSA-10
B	Electrical Synchronizer SN-166/FSA-10
C	Power Supply PP-1386/FSA-10
D	Signal Selector
E	Radar Signal Simulator SM-86/FSA-10
F	Power Supply PP-1386/FSA-10
G	Electronic Control Amplifier AM-1357/FSA-10
H	Power Supply PP-1386/FSA-10
I	Power Supply PP-1386/FSA-10
J	Power Supply PP-1387/FSA-10
K	Fuse Panel

g. Place FIL switch S502 in the ON position on each Video Decoder KY-188/FSA-10 shown in figure 4-5.

h. Refer to figure 4-5 and place FILAMENTS switch S702 and MOTOR switch S703 in their ON positions on each Electrical Synchronizer SN-166/FSA-10.

i. Place FILAMENT POWER switch S902 in the ON position on each Sweep Generator SG-132/FSA-10 shown in figure 4-5.

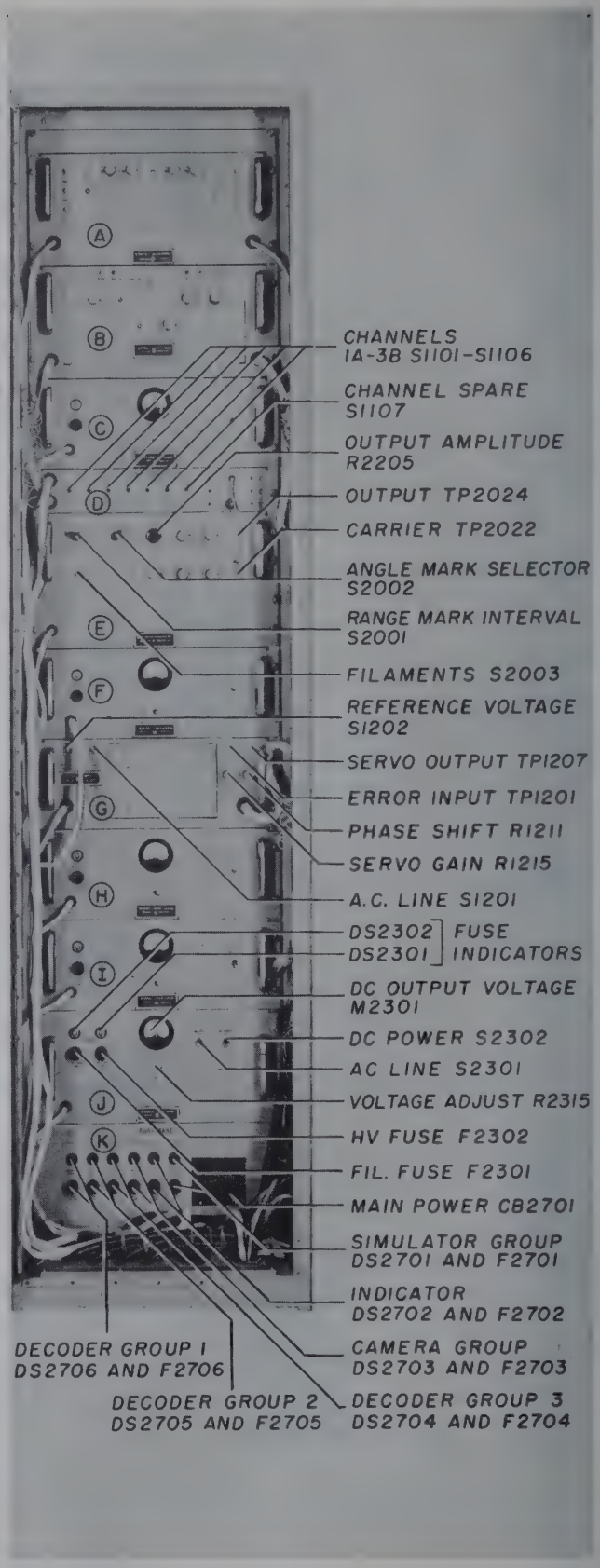


Figure 4-4. Simulator Group OA-992/FSA-10, Installation Adjustments

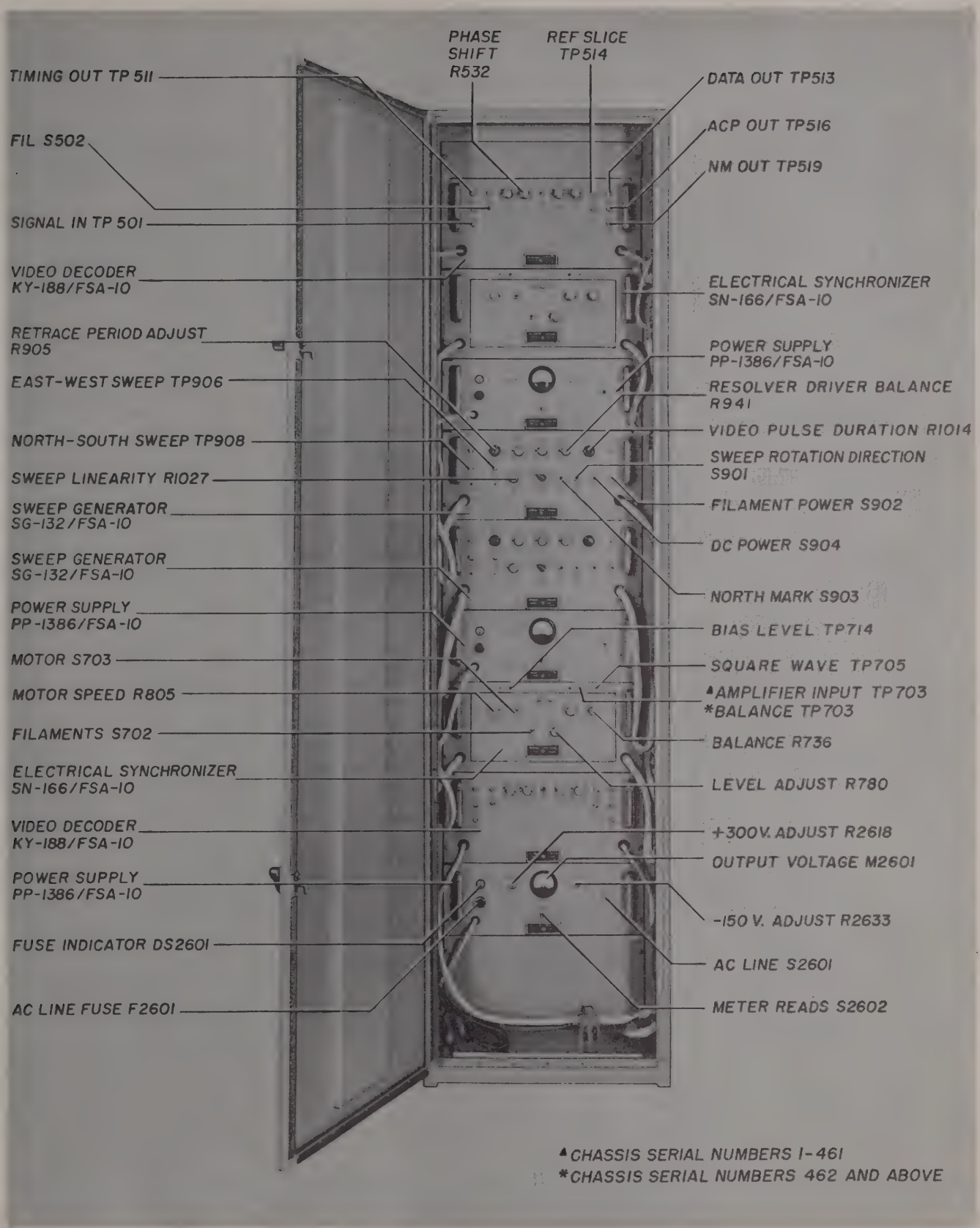


Figure 4-5. Decoder Group OA-993/FSA-10, Installation Adjustments

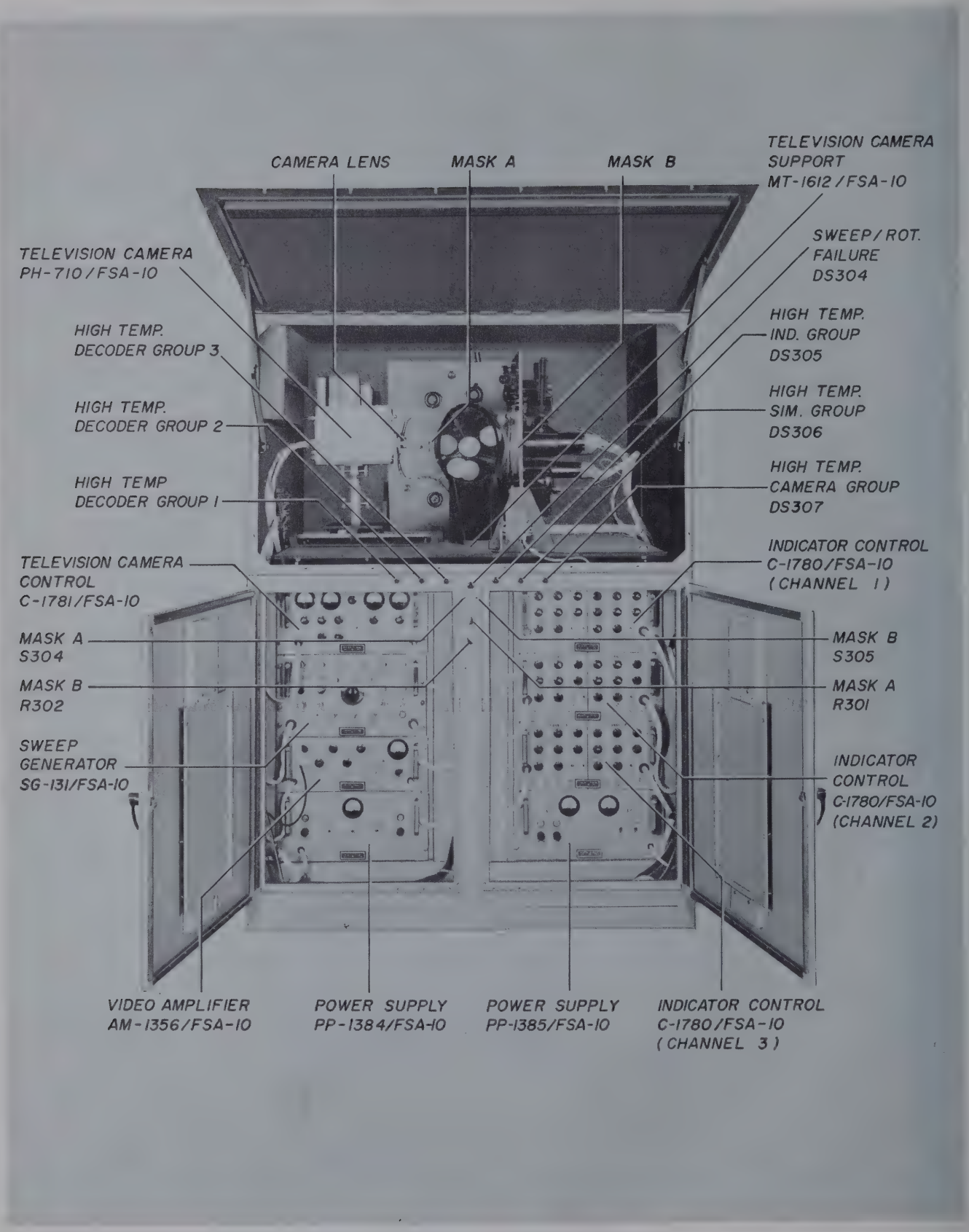


Figure 4-6. Television Camera Group OA-991/FSA-10, Installation Adjustments

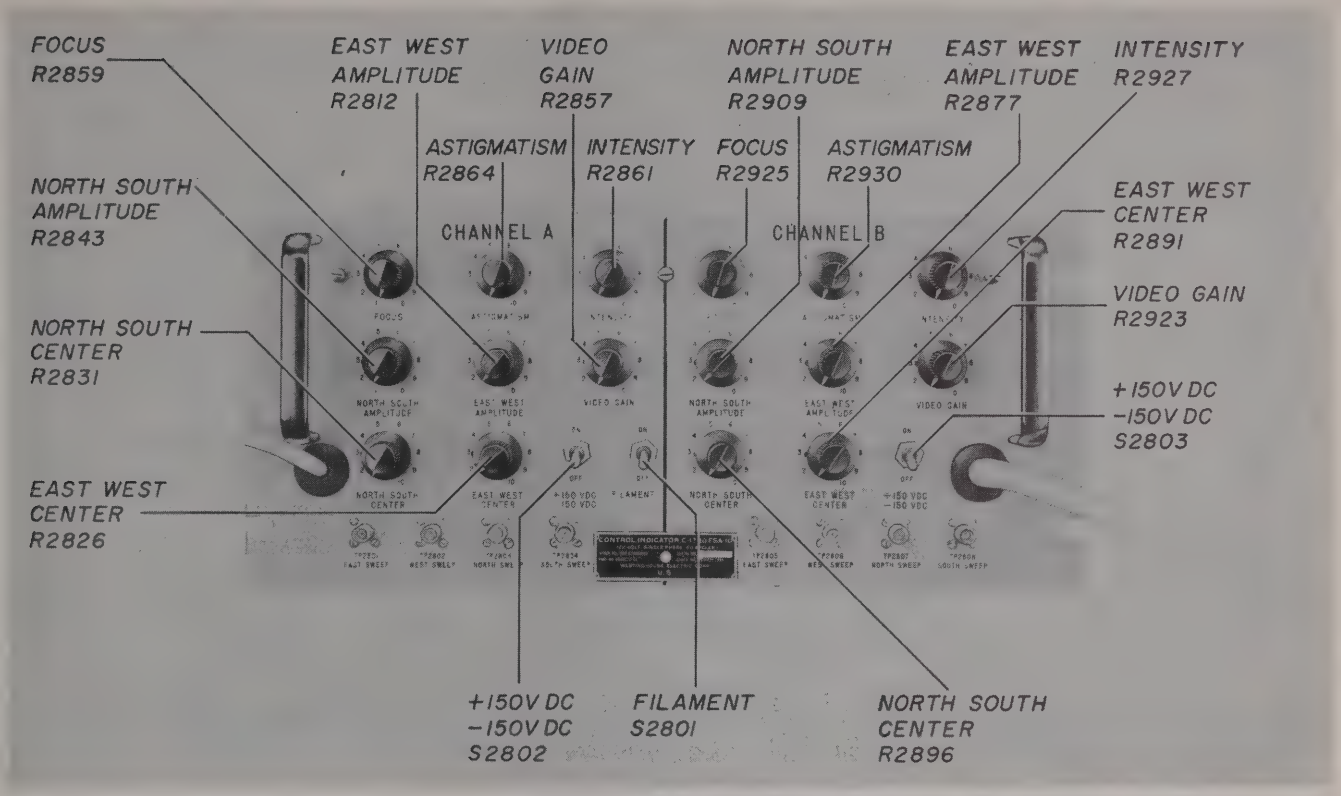


Figure 4-7. Indicator Control C-1780/FSA-10, Installation Adjustments

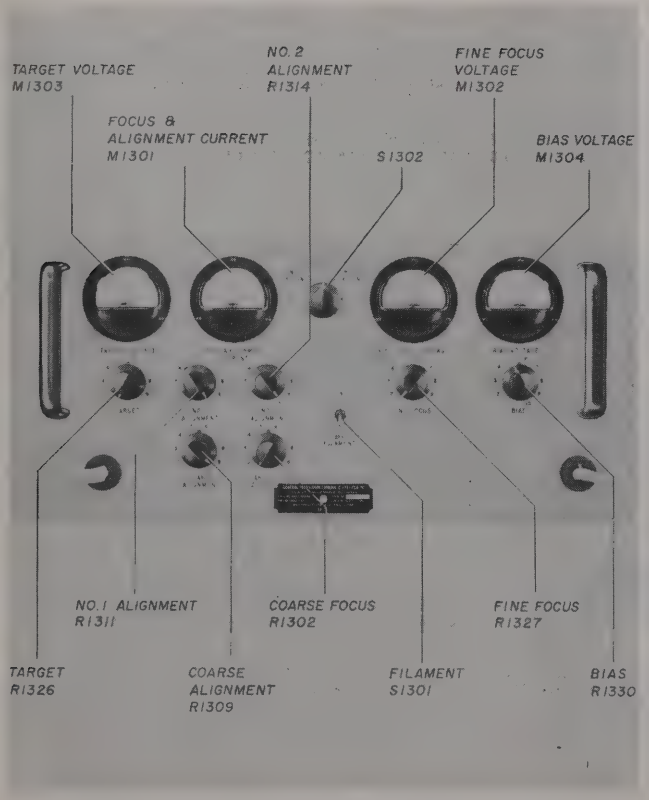


Figure 4-8. Television Camera Control C-1781/FSA-10, Installation Adjustments

j. Refer to figures 4-6 and 4-7 and place FILAMENT switch S2801 in the ON position on each Indicator Control C-1780/FSA-10 being used. The top assembly is connected to Decoder Group OA-993/FSA-10 number one. The bottom two assemblies are connected to Decoder Groups OA-993/FSA-10 two and three respectively, when used.

k. In Simulator Group OA-992/FSA-10, refer to figure 4-4 and energize Power Supply PP-1386/FSA-10 by placing AC LINE switch S2601 in its ON position. Remove AC LINE fuse F2601 from its holder and see that the FUSE INDICATOR lamp DS2601 lights. Replace fuse F2601. Check to see that OUTPUT VOLTAGE meter M2601 registers.

l. See that the filaments of the tubes in Radar Signal Simulator SM-86/FSA-10 are glowing. Allow at least one-half hour for warm-up of Radar Signal Simulator SM-86/FSA-10.

m. Refer to figures 4-6 and 4-8 for location of Television Camera Control C-1781/FSA-10. Place FILAMENT switch S1301 in the ON position on Television Camera Control C-1781/FSA-10 and turn BIAS control R1330 fully clockwise.

n. Place A. C. LINE switch S1201 and REFERENCE VOLTAGE switch S1202 in their ON positions. See figure 4-4.

o. Place FILA switch S1803 in the ON position on Sweep Generator SG-131/FSA-10. See figure 4-9.

p. Place FILAMENTS switch S1702 (figures 4-6

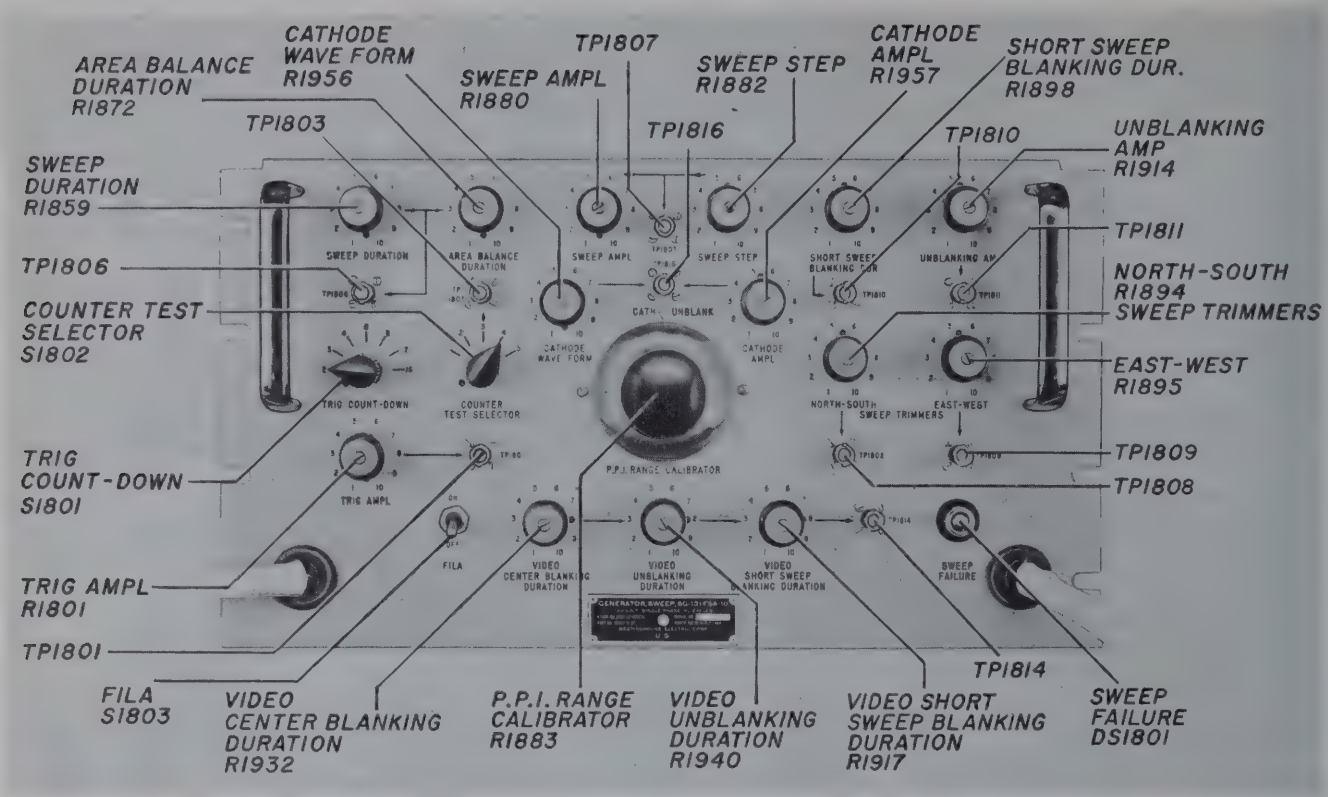


Figure 4-9. Sweep Generator SG-131/FSA-10, Installation Adjustments

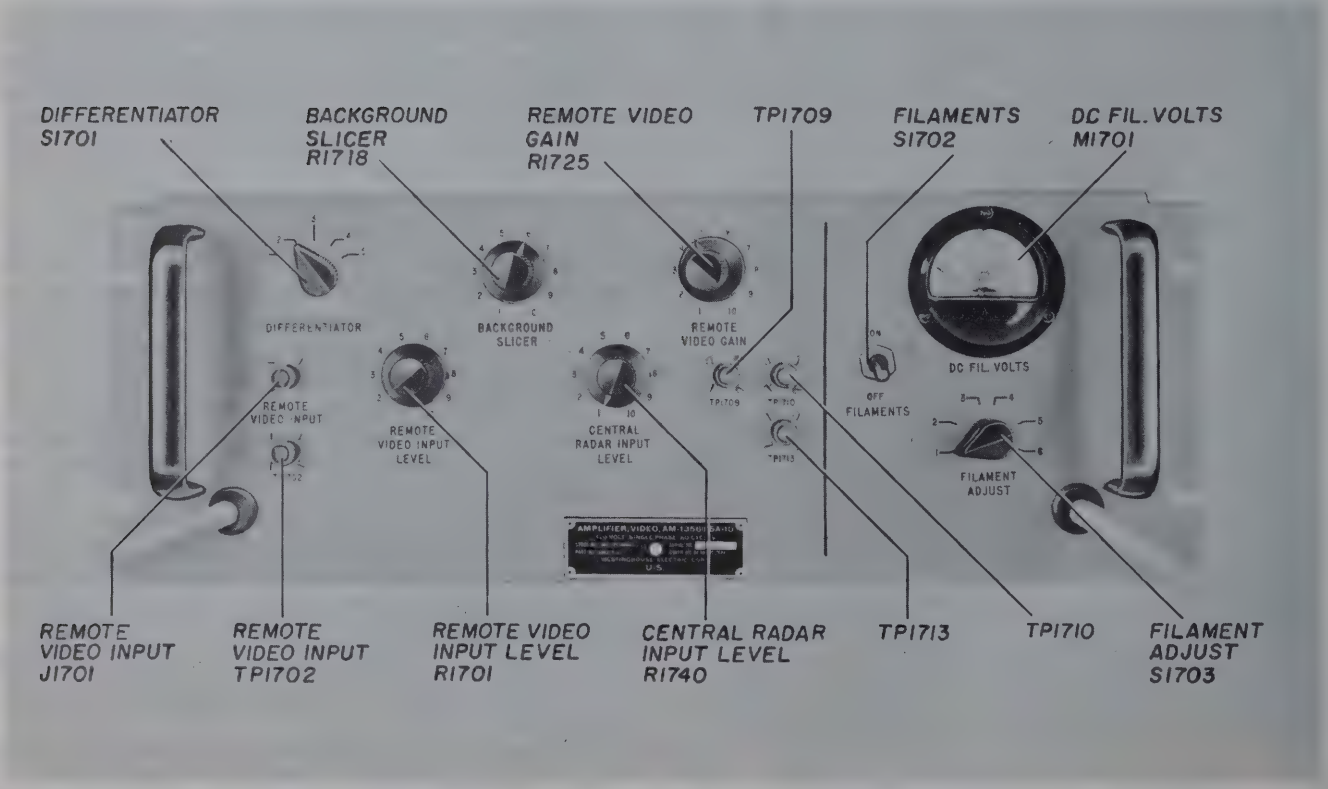


Figure 4-10. Video Amplifier AM-1356/FSA-10, Installation Adjustments

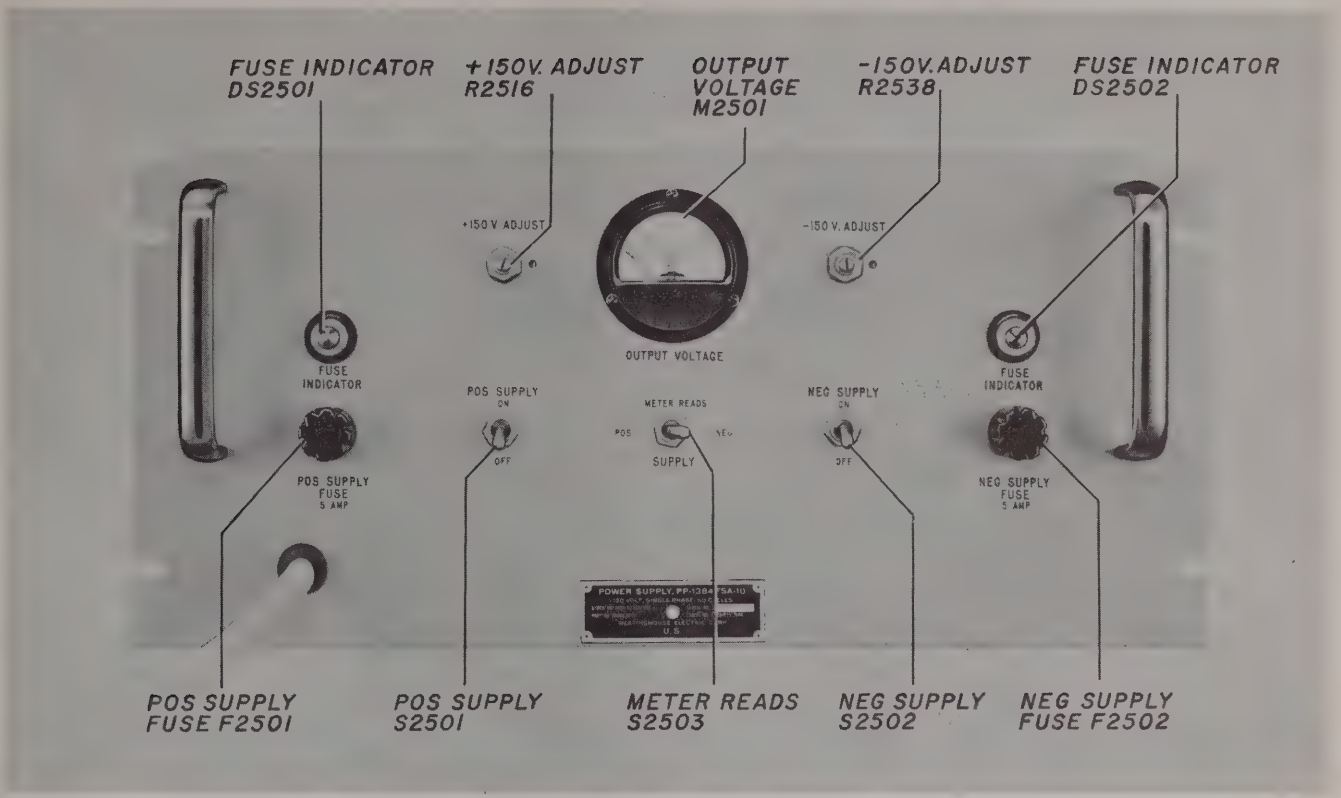


Figure 4-11. Power Supply PP-1384/FSA-10, Installation Adjustments

and 4-10) in the ON position. Position FILAMENT ADJUST switch S1703 to obtain 6.3 volts on DC FIL VOLTS meter M1701.

q. Place AC LINE switch S2601 in the ON position on the two Power Supplies PP-1386/FSA-10 located in Simulator Group OA-992/FSA-10. See figure 4-4. Check the FUSE INDICATORS in each power supply and see that OUTPUT VOLTAGE meter M2601 registers. Check to see that the filaments of the tubes in each associated assembly are glowing. SWEEP FAILURE lamp DS1801 (figure 4-9) on Sweep Generator SD-131/FSA-10 and SWEEP/ROT. FAILURE lamp DS304 (figure 4-6) on the front of Television Camera Group OA-991/FSA-10 should not be energized when the circuits are operating properly.

r. Test the SWEEP FAILURE lamp DS1801 and SWEEP/ROT. FAILURE lamp DS304 by placing AC LINE switch S2601 (figure 4-4) in the OFF position in Power Supply PP-1386/FSA-10. Both lamps should light. Place AC LINE switch S2601 in the ON position and both lamps should go out.

s. Refer to figure 4-4 and place REFERENCE VOLTAGE switch S1202 in the OFF position. SWEEP/-ROT. FAILURE lamp DS304, shown in figure 4-6, should light. Place REFERENCE VOLTAGE switch S1202 in the ON position. The lamp should go out.

t. Allow one hour of warm up before proceeding.

u. At the Signal Selector, shown in figure 4-4, turn the channel switch to SIMULATOR for each channel that is to be checked.

v. Place AC LINE switch S2601 in the ON position on Power Supplies PP-1386/FSA-10. See figure 4-5. Check the FUSE INDICATORS in each power supply and see that the OUTPUT VOLTAGE meters M2601 register.

w. Check to see that the filaments of the tubes are glowing in each Video Decoder KY-188/FSA-10, Electrical Synchronizer SN-166/FSA-10 and Sweep Generator SG-132/FSA-10 shown in figure 4-5.

x. Place AC LINE switch S2301 and DC POWER switch S2302 in their ON positions. See figure 4-4. After a 40-second time delay, the DC OUTPUT VOLTAGE meter, M2301, should register. Check the FUSE INDICATORS to see that they operate properly.

Note

The hood must be in place on Power Supply PP-1387/FSA-10. S402 must be bypassed when the rear door of Simulator Group OA-992/FSA-10 is open. S302 and 303 must be bypassed when the rear doors of Television Camera Group OA-991/FSA-10 are open.

y. Place the POS SUPPLY switch S2501 and the NEG SUPPLY switch S2502 in their ON positions. See figure 4-11. Check both FUSE INDICATORS. The OUTPUT VOLTAGE meter, M2501, should be checked for an indication.

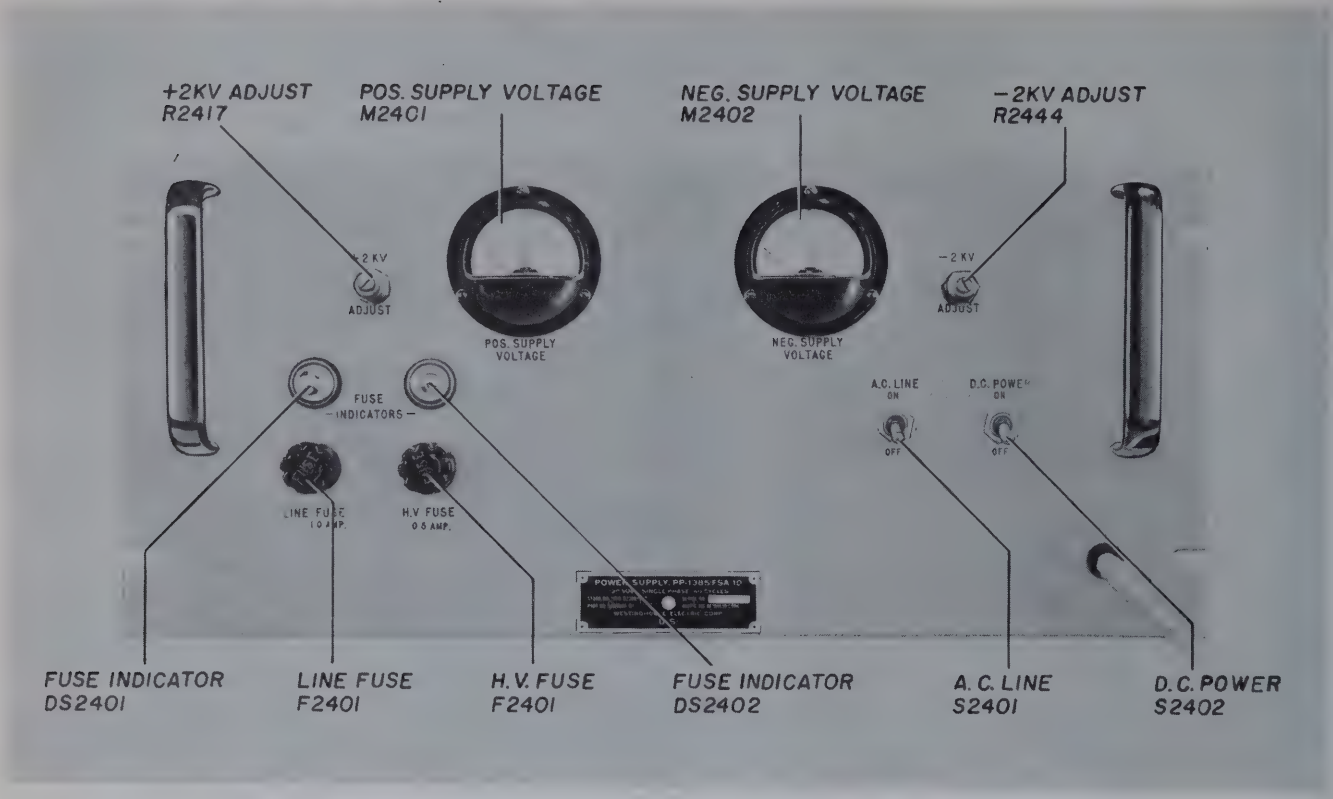


Figure 4-12. Power Supply PP-1385/FSA-10, Installation Adjustments

z. Energize Power Supply PP-1385/FSA-10, shown in figure 4-6, by placing A. C. LINE switch S2401 and D. C. POWER switch S2402 in their ON positions. See figure 4-12. Check the two FUSE INDICATORS after the 10-second delay period when the POS. SUPPLY VOLTAGE meter M2401 and NEG. SUPPLY VOLTAGE meter M2402 register.

Note

The hood for Power Supply PP-1385/FSA-10 must be in place to keep hood interlock switch S2403 closed. In addition, door interlock switches S302 and S303 must be bypassed when the rear doors of Television Camera Group OA-991/FSA-10 are open.

aa. On Indicator Control C-1780/FSA-10, place the +150 VDC −150 VDC CHANNEL A switch S2802 and/or CHANNEL B switch S2803 in the ON position for all channels being used. See figure 4-7. The three-inch PPI tubes and associated circuits are now energized.

ab. Refer to figure 4-13 and place POWER switch S3001, in Azimuth and Range Indicator IP-346/FSA-10, in its ON position. Check to see that blower B3001 in Azimuth and Range Indicator IP-346/FSA-10 is running and that the digit indicator glow tubes are lighted.

Note

High voltage interlock switch S3002 must be closed or bypassed before Azimuth and Range Indicator IP-346/FSA-10 can be energized.

4-31. ALIGNMENT.

4-32. GENERAL. The components of Television Converter-Display Group AN/FSA-10 have been adjusted and aligned at the factory with the equipment connected for a simulated condition of normal operation. It will be necessary, however, to check the alignment of each assembly to ensure that shipping has not upset the final adjustments made at the factory. The following paragraphs describe alignment checks to be made after Television Converter-Display Group AN/FSA-10 has been energized as outlined in paragraph 4-29. Instructions are also provided for adjusting Television Converter-Display Group AN/FSA-10 for two ranges of operation, namely, 100 miles and 150 miles depending on the installation site. In addition, the procedure for orienting the small PPI tubes so that their positions correspond geographically to associated remote radar sets is outlined at the end of this section. It is recommended that a ten to one attenuator be used in the oscilloscope line when observing waveforms at all test points except where the signal level is low. Refer to figures 4-4 through 4-13 for the locations of the installation adjustments and controls.

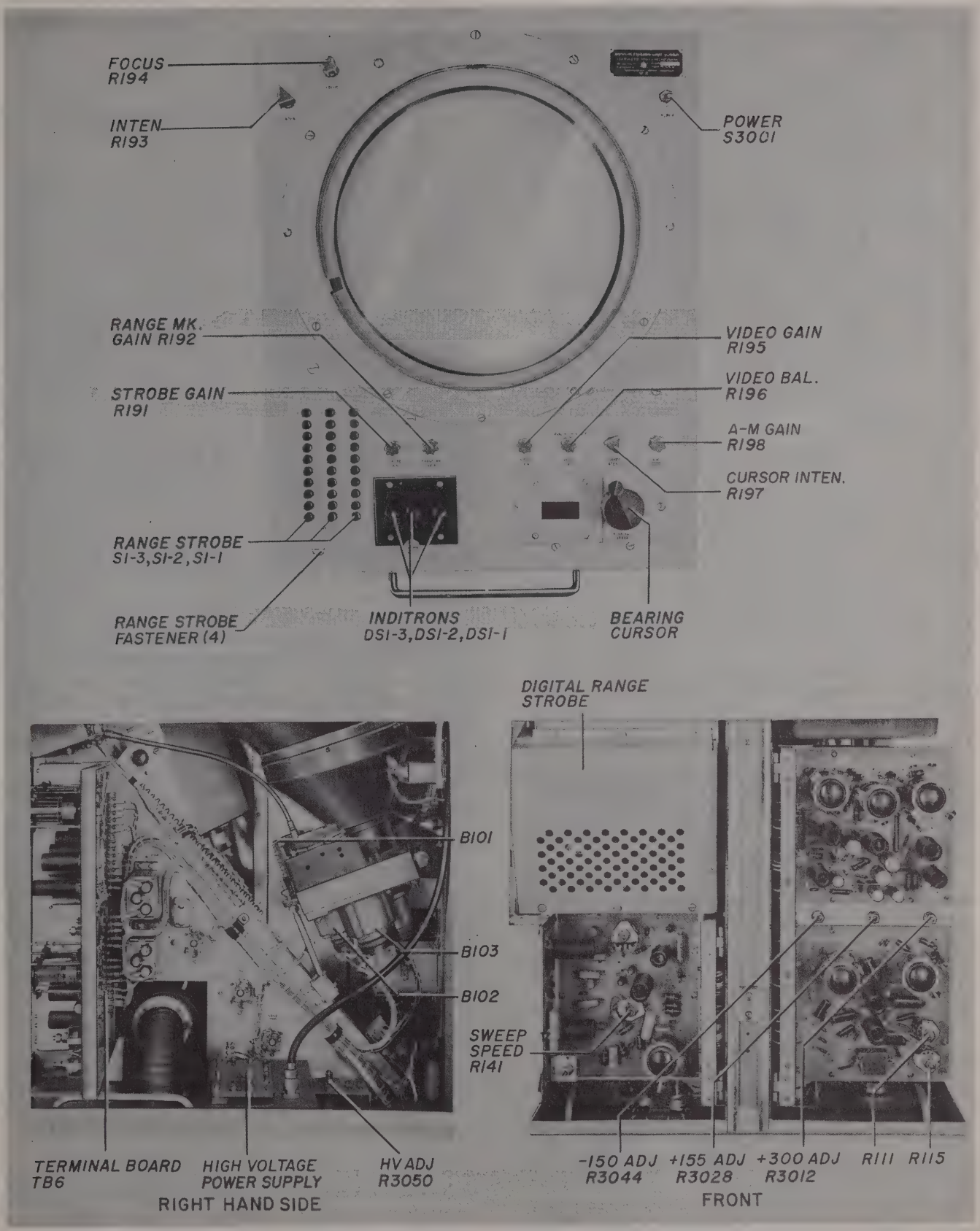


Figure 4-13. Azimuth and Range Indicator IP-346/FSA-10, Installation Adjustments

4-33. POWER SUPPLY PP-1384/FSA-10. One Power Supply PP-1384/FSA-10 is located in Television Camera Group OA-991/FSA-10. See figures 4-6 and 4-11. Check the adjustment of Power Supply PP-1384/FSA-10 as follows:

a. With METER READS switch S2503 in its POS position, OUTPUT VOLTAGE meter M2501 should indicate 150 volts.

b. Adjust the +150 V. ADJUST potentiometer R2516 if the meter indication is in error.

c. Place the METER READS switch in the NEG position.

d. The OUTPUT VOLTAGE meter should indicate 150 volts.

e. Adjust the −150 V. ADJUST potentiometer R2538 if the meter indication is in error.

4-34. POWER SUPPLY PP-1386/FSA-10. Three Power Supplies PP-1386/FSA-10 are located in Decoder Group OA-993/FSA-10 (figure 4-5) and four are located in Simulator Group OA-992/FSA-10 (figure 4-4). Check the adjustment of each Power Supply PP-1386/FSA-10 as follows: (Controls are located on the bottom unit, figure 4-5.)

a. With METER READS switch S2602 in its POS position, OUTPUT VOLTAGE meter M2601 should indicate +300 volts.

b. Adjust +300 V. ADJUST potentiometer R2618 if the meter indication is abnormal.

c. Place the METER READS switch S2602 in the NEG position.

d. The OUTPUT VOLTAGE meter M2601 should indicate −150 volts.

e. Adjust the −150 V. ADJUST potentiometer R2633 if the meter indication is abnormal.

4-35. POWER SUPPLY PP-1387/FSA-10. One Power Supply PP-1387/FSA-10 is located in Simulator Group OA-992/FSA-10 as shown in figure 4-4. Check the adjustment of Power Supply PP-1387/FSA-10 as follows:

a. After the initial time delay of approximately 40 seconds the DC OUTPUT VOLTAGE meter M2301 should indicate +600 volts.

b. Adjust VOLTAGE ADJUST potentiometer R2315 if the meter indication is abnormal.

Note

The hood for Power Supply PP-1387/FSA-10 must be in place to keep interlock switch S2303 closed.

4-36. POWER SUPPLY PP-1385/FSA-10. One Power Supply PP-1385/FSA-10 is located in Television Camera Group OA-991/FSA-10. See figures 4-6 and 4-12. Check the adjustment of Power Supply PP-1385/FSA-10 as follows:

a. After the initial time delay of about 10 seconds, POS. SUPPLY VOLTAGE meter M2401 should indicate +2000 volts and NEG. SUPPLY VOLTAGE meter M2402 should indicate −2000 volts.

b. Adjust +2 KV ADJUST potentiometer R2417 and/or −2 KV ADJUST potentiometer R2444 if either reading is abnormal.

Note

The hood for Power Supply PP-1385/FSA-10 must be in place to keep hood interlock switch S2403 closed.

4-37. RADAR SIGNAL SIMULATOR SM-86/FSA-10. Power Supply PP-1386/FSA-10, located directly beneath Radar Signal Simulator SM-86/FSA-10, supplies the regulated d-c voltage required for operation of Radar Signal Simulator SM-86/FSA-10. See figure 4-4. The output from Radar Signal Simulator SM-86/FSA-10 simulates a signal with the same characteristics as the signal fed to Television Converter-Display Group AN/FSA-10 from the telephone line. The simulated signal is distributed at the signal selector to any desired channel when the channel signal selector switch is placed in the SIMULATOR position. Thus, the operation of a particular channel may be checked by using the signal from Radar Signal Simulator SM-86/FSA-10. The simulated signal will be used in adjusting and aligning Television Converter-Display Group AN/FSA-10 as described in the remainder of this section. Therefore, the adjustment of Radar Signal Simulator SM-86/FSA-10 should be checked first to make sure that the correct signal is produced. Allow approximately one-half hour to elapse after applying power. *Do not unlock the front panel adjustment controls.* These adjustments have been set at the factory. To determine if shipping has upset the factory adjustments, refer to figure 4-4 and proceed as follows:

a. Set RANGE MARK INTERVAL switch S2001 to six miles.

b. Set ANGLE MARK SELECTOR switch S2002 to 5.6 degrees.

c. Open the rear cabinet door on Simulator Group OA-992/FSA-10 and locate printed circuit board E2004 (second board from left). Connect the trigger-sync input of an oscilloscope (OS-48 or equivalent) to 7TH DIV OUTPUT test point TP2008 (located on E2004) through a 51 μμf capacitor. Connect the signal probe to front panel CARRIER test point TP2022. The waveform should be nearly sinusoidal with a frequency of 2000 cps.

d. Connect the oscilloscope probe to front panel OUTPUT test point TP2024.

e. Adjust OUTPUT AMPLITUDE control R2205 for a carrier amplitude of 0.25 volts peak-to-peak on the oscilloscope. The output should have the following characteristics:

Timing pulses—0.31 volts peak-to-peak
Range marks—0.63 volts peak-to-peak
North marks and azimuth change pulses—1.0 volt peak-to-peak

f. Adjust OUTPUT AMPLITUDE control R2205 for an azimuth change pulse amplitude of 0.5 volts peak-to-peak on the oscilloscope.

g. Place RANGE MARK INTERVAL switch S2001 in the 3 and 1.5 miles positions successively, and observe on the oscilloscope that the range mark interval is reduced by one-half when the switch is placed in the next lower range-mark-interval position.

h. Place RANGE MARK INTERVAL switch S2001 in the 6 miles position.

i. Connect the oscilloscope probe to NM/ACP test point TP2017 located on printed circuit board E2007 (second from right) at the rear of the chassis. Note that at intervals of 11.52 seconds the pulse will double its duration.

j. Connect the oscilloscope probe to front panel OUTPUT test point TP2024.

k. With ANGLE MARK SELECTOR switch S2002 set at 5.6 degrees, the range mark modulation should occur during every fourth azimuth change pulse interval.

l. Leave the OUTPUT AMPLITUDE control R2205 set for an azimuth change pulse amplitude of 0.5 volts peak-to-peak on the oscilloscope.

m. All of the above adjustments are made with the load applied through the Signal Selector. Make sure that the selector switch on the signal selector is in SIMULATOR position for each channel being checked.

4-38. VIDEO DECODER KY-188/FSA-10. Refer to figure 4-5 and check the alignment of Video Decoder KY-188/FSA-10 in each channel as follows using the signal from Radar Signal Simulator SM-86/FSA-10: (Controls are located on channel A unit, figure 4-5.)

a. Connect the oscilloscope trigger to terminal 4 on the chassis fanning strip E502. Connect the oscilloscope signal probe to front panel SIGNAL IN test point TP501. The signal should be the same as the Radar Signal Simulator SM-86/FSA-10 output except that it will be of greater amplitude.

b. Connect the oscilloscope probe to DATA OUT test point TP513. The pulse shape should be +40 volts amplitude and 0.5 microseconds duration. The interval between pulses should be five milliseconds (6 mile simulated data).

c. Connect the oscilloscope probe to ACP OUT test point TP516. The pulse shape should be same as in step b, with an interval between pulses of 45 milliseconds. Connect the oscilloscope probe to TIMING OUT test point TP511. The pulse shape should be the same as in b. The interval between pulses should be about 625 microseconds.

d. Connect the oscilloscope probe to NM OUT test point TP519. Using an insulated tube puller remove tube V517. The pulse shape should be the same as in step b. The interval between pulses should be about 45 milliseconds.

e. Replace tube V517.

f. The pulse at NM OUT test point TP519 should occur every 11.52 seconds. Check the interval by using the pulse to trigger the sweep of the oscilloscope.

g. When the four outputs described in the preceding steps are shown properly on the oscilloscope, Video Decoder KY-188/FSA-10 is operating properly.

4-39. ELECTRICAL SYNCHRONIZER SN-166/FSA-10 AND ELECTRICAL SYNCHRONIZER SN-166A/FSA-10. Electrical Synchronizer SN-166/FSA-10 is the nomenclature for chassis serial numbers 1 through 461. Electrical Synchronizer SN-166A/FSA-10 is the nomenclature for chassis serial numbers 462 and above. For installations using Electrical Synchronizer SN-166/FSA-10 follow the procedure in steps a through h of this paragraph. For installations using Electrical Synchronizer SN-166A/FSA-10 follow the procedure in steps i through q of this paragraph. Refer to figure 4-5 and check the adjustment of Electrical Synchronizer SN-166/FSA-10 or SN-166A/FSA-10 in each channel as follows, using the signal from Radar Signal Simulator SM-86/FSA-10: (Controls are located on channel B unit, figure 4-5.)

a. Allow a warmup period of 30 minutes. (Steps a through h apply to Electrical Synchronizer SN-166/FSA-10 only.)

b. Connect a jumper between AMPLIFIER INPUT test point TP703 and test point TP704. This jumper grounds the input to the d-c amplifier.

c. Release the front panel door latch and allow the door to tilt forward. Connect Multimeter ME-26/U or equivalent, set on a-c volts, 300-volt range, between terminals 2 and 4 of motor B701. The voltmeter should indicate 96 volts a-c (rms). Adjust MOTOR SPEED potentiometer R805 if the reading is abnormal.

d. Connect the multimeter, set on −30-volt range, to BIAS LEVEL test point TP714, located on the front panel. The meter should indicate −15 volts d-c. Adjust LEVEL ADJUST potentiometer R780 if the reading is abnormal.

Note

When the potentiometers are locked, make sure that the adjustment is not disturbed.

e. Remove the jumper from AMPLIFIER INPUT test point TP703 and test point TP704.

f. Locate switch S701 and cam assembly behind the front panel door. Insert the blade of a small screwdriver under the back of switch S701 lever arm so that the switch arm is lifted clear of the cam. Connect an oscilloscope (OS-48 or equivalent) to SQUARE WAVE test point TP705. Set the oscilloscope on negative internal sync and adjust the synchronizing controls until a stationary and symmetrical square wave is seen. Adjust BALANCE potentiometer R736 for a symmetrical square wave. Wait several minutes to insure that the pattern remains stable. Remove the screwdriver blade from switch S701.

g. The MOTOR SPEED potentiometer R805 and BALANCE potentiometer R736 should be adjusted until both the −15-volt indication and the symmetrical square wave are obtained. Close the front panel door on the chassis and secure the latch.

h. Connect the oscilloscope probe to BRAKE VOLTAGE test point TP701. The waveshape will

initially be disturbed with each actuation of switch S701. After three or four minutes the waveform should stabilize and should not disappear if Electrical Synchronizer SN-166/FSA-10 is operating properly. After the waveform at BRAKE VOLTAGE test point TP701 stabilizes check the duration of the waveform at GATE IN test point TP723. Stop the motor by holding the brake disc. Release the brake disc and observe the waveform at GATE IN test point TP723. The duration of the waveform should not change as the unit comes into north alignment.

i. The remaining steps apply to Electrical Synchronizer SN-166A/FSA-10. Allow a warmup period of 15 minutes.

j. Connect Multimeter ME-26/U or equivalent, set on d-c volts, 30-volt range, to BALANCE test point TP703. If the unit is close to frequency lock, a damped excursion of the meter movement should be observed.

k. Release the front panel door latch and allow the door to tilt forward. Locate switch S701 and cam assembly behind the front panel door. Insert a small piece of cardboard under the back of switch S701 lever arm so that the switch arm is lifted clear of the cam.

l. Connect an oscilloscope (OS-48 or equivalent) to SQUARE WAVE test point TP705. Synchronize the oscilloscope internally and adjust the synchronizing controls until a stationary and symmetrical square wave is seen. Adjust MOTOR SPEED control R805 for a symmetrical square wave, i.e. the duration of the positive and negative portions are equal.

m. Momentarily stop the brake disc by hand and observe the multimeter and oscilloscope. The meter movement should smooth out and steady down several seconds after the brake disc is released. The symmetrical square waveform should be restored simultaneously with the steady reading of the multimeter. If the waveform responds as indicated, the unit is in frequency lock.

n. If frequency lock is not obtained adjust LEVEL ADJUST control R780 until the multimeter movement smooths out. When the multimeter movement has steadied down, observe the symmetry of the square wave, which may have to be readjusted with MOTOR SPEED control R805.

o. Remove the piece of cardboard from switch S701. Disconnect the multimeter from BALANCE test point TP703.

p. Open the rear door of Electrical Equipment Cabinet CY-1970/FSA-10 and locate test point TP706 on the rear of Electrical Synchronizer SN-166A/FSA-10. Connect the oscilloscope probe to test point TP706. A positive pulse 135 milliseconds in duration should be observed every time switch S701 is actuated if Electrical Synchronizer SN-166A/FSA-10 is running synchronized. Electrical Synchronizer SN-166A/FSA-10 may require a few minutes to pull into phase lock before the correct waveform is observed at test point TP706.

Note

When operating on simulated ACP's Electrical Synchronizer SN-166A/FSA-10 may lock on four ACP's out of synchronism, which is shown by a positive pulse about 315 milliseconds in duration at test point TP706. The correct waveform can be obtained by introducing jitter into the system. This is done by applying, with the finger, momentary friction to the brake disc just before the arm of switch S701 falls in the notch of the cam. This will not be encountered when operating on a phone line signal since the phone line ACP jitters enough to prevent locking on four ACP's out.

q. Disconnect the oscilloscope and close the rear door of Electrical Equipment Cabinet CY-1970/FSA-10. Close the front panel door of Electrical Synchronizer SN-166A/FSA-10 and secure the latch.

4-40. AZIMUTH AND RANGE INDICATOR IP-346/FSA-10. Azimuth and Range Indicator IP-346/FSA-10 receives all its inputs through the cable from Simulator Group OA-992/FSA-10. Refer to figure 4-13 for the locations of the Azimuth and Range Indicator IP-346/FSA-10 adjustments and controls used during installation. Proceed as follows to align and adjust Azimuth and Range Indicator IP-346/FSA-10:

Note

When the doors of Azimuth and Range Indicator IP-346/FSA-10 are opened to make the following adjustments, the high voltage door interlock switch S3002 must be bypassed by pulling out the switch plunger.

a. To check the outputs of the power supplies, first set Multimeter ME-26/U or equivalent on the 1000-volt range, d-c scale.

b. Place POWER switch S3001, figure 4-13, in its OFF position.

WARNING

Dangerous voltages are present in Azimuth and Range Indicator IP-346/FSA-10. Two persons must always be present and every safety precaution must be observed. Place POWER switch S3001 in the OFF position and ground all terminals before touching any circuitry inside of Azimuth and Range Indicator IP-346/FSA-10.

c. Open the doors of Azimuth and Range Indicator IP-346/FSA-10 and connect the multimeter test leads

between terminal 2 on terminal board TB6 (shown in figure 4-13) and ground.

d. Place POWER switch S3001 in the ON position.

e. The multimeter should indicate 300 volts. Adjust +300 ADJ potentiometer R3012, shown in figure 4-13, for a reading of precisely 300 volts.

f. Place POWER switch S3001 in the OFF position.

g. Disconnect the multimeter test lead from terminal 2 and connect it to terminal 3 of terminal board TB6.

h. Set the multimeter on the 300-volt range, d-c scale.

i. Place POWER switch S3001 in the ON position.

j. The meter should indicate +155 volts. Adjust +155 ADJ potentiometer R3028, shown in figure 4-13, for precisely +155 volts.

k. Place POWER switch S3001 in the OFF position.

l. Disconnect the multimeter test lead from terminal 3 and connect it to terminal 4 of terminal board TB6. Set the multimeter on the 300-volt range, minus d-c scale.

m. Place POWER switch S3001 in the ON position.

n. The meter should indicate −150 volts. Adjust −150 ADJ potentiometer R3044, shown in figure 4-13, for precisely −150 volts.

o. Place POWER switch S3001 in the OFF position.

p. Disconnect the multimeter test leads.

q. Make sure POWER switch S3001 is in the OFF position and prepare to measure the output of the high voltage power supply.

WARNING

Use extreme care when measuring the voltage output of the high voltage power supply. This supply produces highly lethal voltages. After removing power from the unit, wait at least 30 seconds before touching the high voltage cable.

r. Open door interlock switch S3002 (figure 4-13) by pushing the switch plunger in.

s. Disconnect the high voltage cable from the high voltage anode connection on PPI tube V142.

t. Set Electrostatic Voltmeter, Model ESH or equivalent, on the 15 KV d-c scale.

u. Connect the voltmeter test lead to the free end of the high voltage cable. Connect the voltmeter common to the chassis ground.

WARNING

Keep all personnel clear of the voltmeter and the high voltage cable.

v. Place POWER switch S3001 in the ON position.

w. Close door interlock switch S3002 by pulling the switch plunger out.

x. The meter should indicate 12 KV. Adjust HV ADJ potentiometer R3050, shown in figure 4-13, for precisely 12 KV.

y. While observing the meter, push in the switch plunger of door interlock switch S3002. The high voltage should go off.

z. Place POWER switch S3001 in the OFF position.

aa. Wait at least 30 seconds and disconnect the voltmeter test leads. Replace the high voltage cable on the anode connection of cathode-ray tube V142.

ab. Place POWER switch S3001 in the ON position nd close the door interlock switch S3002 by pulling he switch plunger out.

ac. Adjust INTEN control R193 for the proper sweep intensity and FOCUS control R194 for best focus. See figure 4-13.

ad. Remove the cover from the digital range strobe and locate printed circuit board E1. On printed circuit board E1 locate OSC OUTPUT test point TP4 and trimmer capacitor C9. Connect Oscilloscope OS-48 or equivalent probe to OSC OUTPUT test point TP4. A sinusoidal oscillation of 809.33 kc (100-mile range) or 539.533 kc (150-mile range) and 50 volts amplitude should be seen. If no waveform appears, adjust trimmer capacitor C9 until oscillations occur. Adjust capacitor C9 for maximum amplitude of oscillation and then readjust for oscillations about three volts less than maximum amplitude.

ae. (Deleted).

af. On printed circuit board E140, adjust SWEEP SPEED potentiometer R141, figure 4-13, until the end of the PPI sweep is just visible at the edge of the cathode ray tube.

ag. Adjust RANGE MK. GAIN control R192, figure 4-13, until the range marks appear on the PPI sweep. For operation on the 100-mile range, 10 range marks should appear; for the 150-mile range, 10 range marks should also appear.

ah. Press RANGE STROBE buttons to indicate 56.0. Adjust STROBE GAIN control R191, figure 4-13, until the strobe appears between the fifth and sixth range marks for the 100-mile range (56.0 miles) or between the fifth and sixth range marks for the 150-mile range (84.0 miles). Check to see that the range indicator lamps show the range corresponding to the RANGE STROBE button pressed.

Note

When operating on the 150-mile range, the numerical range indicators must be multiplied by 1.5.

WARNING

Proceed with extreme caution when adjusting the centering magnets since high voltage is present in the vicinity.

ai. If the PPI sweep requires centering, determine the geometric center of the cathode ray tube and mark it with a china-marking pencil. Loosen the screws holding the centering magnets (shown in figure 4-1), and adjust the magnets until the center of the PPI

sweep coincides with the geometric center of the PPI tube.

aj. To align synchro control transformers B102 and B103 (figure 4-13) with the central-radar synchros, first make sure that the synchros in the antenna of the central radar set are zeroed electrically.

ak. Set potentiometer R115, figure 4-13, as far clockwise as possible without causing oscillation of the servo system.

al. Place POWER switch S3001, figure 4-13, in the OFF position.

am. Tag and remove leads S1, S2, and S3 from 36-speed synchro B102.

an. Place POWER switch S3001 in the ON position. Rotate the antenna of the central radar set to precisely 000 degrees (north).

Note

The north azimuth marker (10-degree or 30-degree, may be used to indicate 000 degrees (north) on Azimuth and Range Indicator IP-346/FSA-10.

ao. Loosen the screws holding one-speed synchro B103 to its mounting and rotate the stator housing until the trace on the PPI tube points to 000 degrees (north). Tighten the screws on B103, making certain that the trace does not move off zero.

ap. Place POWER switch S3001 in the OFF position. Jumper terminal S1 of B102 to terminal S1 of B103. Jumper terminal S2 of B102 to terminal S2 of B103. Jumper terminal S3 of B102 to terminal S3 of B103. These connections apply one-speed synchro data to both B102 and B103. Place POWER switch S3001 in the ON position. If necessary, reduce the setting of potentiometer R115 just enough to prevent oscillation of the servo gear assembly.

aq. Loosen the screws holding 36-speed synchro B102 to its mounting and rotate the stator housing until the trace on the PPI tube points to 000 degrees (north). Be very careful when making this adjustment. Tighten the screws on B102 making certain that the trace does not move off zero.

ar. Place POWER switch S3001 in the OFF position. Remove the jumpers between B102 and B103 and replace the normal leads on terminals S1, S2 and S3 of B102.

as. Connect the X input of Oscilloscope OS-48 (or equivalent) to terminal 2 of servo motor B101. Connect the Y input of the oscilloscope to terminal 3 of servo motor B101.

Note

Keep the connecting test leads as short as possible since a-c pickup will distort the pattern.

at. Place POWER switch S3001 in the ON position. As the servo motor B101 rotates several revolutions observe the pattern on the oscilloscope.

au. Adjust potentiometer R111 (figure 4-13) for the most circular pattern. Remove the oscilloscope connections.

av. Place POWER switch S3001 in the OFF position.

aw. Disconnect the lead from terminal 2 of terminal board TB6. Tape the lead to prevent shorting.

ax. Place POWER switch S3001 in the ON position. Rotate the central-radar antenna 90 degrees from its previous position.

ay. Place POWER switch S3001 in the OFF position. Reconnect the lead to terminal 2 of terminal board TB6.

az. Place POWER switch S3001 in the ON position and observe the PPI trace. If the PPI sweep comes to the new position with no more than one overshoot, potentiometer R115 is adjusted properly. If not, adjust potentiometer R115 to obtain the correct result.

az1. Connect Oscilloscope OS-48 or equivalent to test point TP101 and ground. With the central-radar antenna turning at a rate of five rpm measure the maximum fluctuation of the top of the error signal pattern. The maximum fluctuation should not exceed 0.3 volts. Reduce the setting of potentiometer R115 is this limit is exceeded.

ba. Lock potentiometers R111 and R115.

bb. Turn CURSOR INTEN. control R197, figure 4-13, clockwise until the PPI sweep is intensified once every revolution.

bc. Rotate the BEARING CURSOR knob until the cursor is pointing due north. The bearing counter should read 000. If the bearing counter indication is incorrect, locate the counter inside the cabinet and temporarily disconnect the flexible shaft at the input to the mechanical counter. Rotate the BEARING CURSOR knob until the reading 000 is obtained.

bd. Reconnect the flexible shaft. The cursor should point due north when the BEARING CURSOR dial reads 000.

be. Close the doors of Azimuth and Range Indicator IP-346/FSA-10.

4-41. ELECTRONIC CONTROL AMPLIFIER AM-1357/FSA-10. Electronic Control Amplifier AM-1357/FSA-10, shown in figure 4-4, receives a regulated +300-volt supply from Power Supply PP-1386/FSA-10. The 120-volt, 60-cps, a-c power is supplied to the filament transformer T1201 when A. C. LINE switch S1201 is placed in the ON position. The synchros in Electronic Control Amplifier AM-1357/FSA-10 must be aligned with the synchro transmitters in the central radar set. Make sure that the central-radar synchro transmitters are properly zeroed before aligning the servo system in Electronic Control Amplifier AM-1357/FSA-10; then, refer to figure 4-4 and proceed as follows:

a. Rotate the central-radar antenna to exactly north (000 degrees).

b. Open the front cabinet door of Simulator Group OA-992/FSA-10. Deenergize Electronic Control Amplifier AM-1357/FSA-10 by turning off the associ-

ated Power Supply PP-1386/FSA-10 and placing A. C. LINE switch S1201, figure 4-4, in the OFF position.

c. Open the rear cabinet door of Simulator Group OA-992/FSA-10 and remove tube V1201 from Electronic Control Amplifier AM-1357/FSA-10.

d. Remove the cover from the front panel of Electronic Control Amplifier AM-1357/FSA-10. Remove the four screws securing the chassis to the cabinet and slide the chassis out exposing the top of the servo gear assembly.

e. Remove the adapter plate from the end of resolver B1204. Line up the mark on the resolver shaft with the mark on the body of the resolver by rotating the motor shaft. The resolver is now approximately in its zero position. Replace the adapter plate on resolver B1204.

f. Loosen the screws holding the synchro control transformers B1202 and B1203 to their respective mountings.

g. Connect Multimeter ME-26/U or equivalent, set on its 300-volt a-c scale, between R1 of synchro control transformer B1203 and ground. Using a clip lead, short out resistor R1203 located on the right side of printed circuit board E1201 on the rear of Electronic Control Amplifier AM-1357/FSA-10.

h. Energize Electronic Control Amplifier AM-1357/FSA-10 by placing A. C. LINE switch S1201 in the ON position and turning on the associated Power Supply PP-1386/FSA-10.

i. Rotate the housing of synchro B1203 until a minimum voltage is indicated on the meter.

j. Tighten the screws holding synchro B1203 to the gear housing.

k. Replace tube V1201. Rotate the central-radar antenna. If synchro B1203 is correctly adjusted, it will follow the central-radar antenna. If the servo system jumps 180 degrees and then follows the antenna, repeat steps f, g, h, i, j, and k with the housing of synchro B1203 rotated 180 degrees.

l. Deenergize Electronic Control Amplifier AM-1357/FSA-10 as in step b.

m. Stop the central-radar antenna. Connect Multimeter ME-26/U or equivalent, set on its 300-volt a-c scale, between ERROR INPUT test point TP1201 and ground. Remove the clip lead shorting resistor R1203. Remove tube V1201.

n. Energize Electronic Control Amplifier AM-1357/FSA-10 as in step h.

o. Rotate the central-radar antenna until a minimum voltage is indicated on the multimeter.

p. Rotate the housing of synchro B1202 until a minimum voltage is indicated on the multimeter. Tighten the screws holding synchro B1202 and replace tube V1201.

q. With the central-radar antenna stopped, the servo system will resist externally applied torque to the servo motor shaft. If a second null position is present a few degrees either side of the first null position, repeat steps l, m, n, o and p with synchro B1202 rotated 180 degrees.

r. Deenergize Electronic Control Amplifier AM-1357/FSA-10 as in step b.

s. Remove the multimeter test leads.

t. Connect the X input of Oscilloscope OS-48 or equivalent to SERVO OUTPUT test point TP1207. Connect the Y input of the oscilloscope to terminal 1 on terminal board TB412 (right side of cabinet).

Note

Keep the connecting test leads as short as possible since a-c pickup will distort the pattern.

u. Energize Electronic Control Amplifier AM-1357/FSA-10 as in step h and rotate the central-radar antenna.

v. Observe the pattern on the oscilloscope while the servo motor is turning several revolutions.

w. Adjust PHASE SHIFT potentiometer R1211 for the most circular pattern. Remove the oscilloscope test leads.

x. Turn off the associated Power Supply PP-1386/FSA-10 and rotate the central-radar antenna 90 degrees from its previous position.

y. Turn on the Power Supply PP-1386/FSA-10 (deenergized in step x) and observe the impeller disc of mercury switch S1203 in Electronic Control Amplifier AM-1357/FSA-10 gearing assembly. If the impeller disc comes to the new position with no more than one overshoot, SERVO GAIN potentiometer R1215 is properly adjusted. If not, adjust SERVO GAIN potentiometer R1215 to obtain the correct result.

y1. Connect the oscilloscope to ERROR INPUT test point TP1201 and ground. With the central-radar antenna turning at a rate of five rpm measure the maximum fluctuation of the top of the error signal pattern. The maximum fluctuation should not exceed 0.3 volts. Reduce the setting of SERVO GAIN potentiometer R1215 if this limit is exceeded.

z. Make sure that PHASE SHIFT potentiometer R1211 and SERVO GAIN potentiometer R1215 are locked.

aa. Deenergize Electronic Control Amplifier AM-1357/FSA-10 as in step b.

ab. Slide the chassis back into the cabinet and replace the front panel screws.

ac. Replace the cover on the front panel of Electronic Control Amplifier AM-1357/FSA-10.

ad. Close the rear cabinet door of Simulator Group OA-992/FSA-10.

ae. Energize Electronic Control Amplifier AM-1357/FSA-10 as in step h.

af. Energize the central-radar antenna drive motor and see that the central-radar antenna is turning at a rate between three and seven rpm.

4-42. SMALL PPI CHANNELS, PRELIMINARY ADJUSTMENT. The adjustments described in the preceding paragraphs complete the alignment of the individual chassis of Television Converter-Display Group AN/FSA-10. Further adjustments must be made on the various chassis as a part of system alignment. The first phase of system alignment consists of the preliminary adjustment of the small PPI channels. Each operating small PPI channel must be adjusted initially for a proper display when the signal from Radar Signal Simulator SM-86/FSA-10 is used. The adjustment controls are located on the associated Indicator Control C-1780/FSA-10. (See figures 4-6 and 4-7.) To perform the alignment, proceed as follows:

CAUTION

The PPI tubes employ sensitive phosphors. Keep the PPI intensity as low as possible during alignment in order to avoid damage to the PPI tube face.

a. Refer to figure 4-4 for the location of Radar Signal Simulator SM-86/FSA-10 and rotate ANGLE MARK SELECTOR switch S2002 to the 90° position. Rotate RANGE MARK INTERVAL switch S2001 to the 6 position. On the signal selector place the selector switches corresponding to the operating PPI channels in the SIMULATOR positions.

b. On the associated Indicator Control C-1780/FSA-10 (channel 1A, 2A, 3A, 1B, 2B or 3B) adjust the FOCUS, INTENSITY, and VIDEO GAIN controls for a sharply defined PPI presentation. The video display on each small PPI should consist of six-mile range marks occurring every 90 degrees. Video gain should be low so that the pattern dots are as small as possible.

c. Observe the small PPI sweep as it rotates and carefully adjust the ASTIGMATISM control on the associated Indicator Control C-1780/FSA-10 for maximum sweep length and clarity at the intercardinal points.

d. The length of the PPI sweep should be about 1.2 inches. Adjust the NORTH SOUTH AMPLITUDE and EAST WEST AMPLITUDE controls for this sweep length and a circular PPI presentation.

4-43. TELEVISION CHANNEL ADJUSTMENT. Before the small PPI's are adjusted any further the television video-combining channel must be calibrated. During the calibration procedure the presentation on each small PPI should be extinguished by turning the VIDEO GAIN control on the associated Indicator Control C-1780/FSA-10 (figure 4-6) to the fully counterclockwise position. To perform the procedure, proceed as follows:

a. Position Television Camera PH-710/FSA-10 with the midpoint of the lens 11.0 inches from map mask B for an installation using a 100-mile maximum range and 16.5 inches from map mask B for an installation using a 150-mile maximum range. The distance from the mirror is identical for direct-viewing and offset PPI tubes.

b. Illuminate map mask B to maximum intensity by placing MASK B switch S305 in the ON position and adjusting MASK B control R302. (See figure 4-6.)

c. Refer to figure 4-9 and set TRIG AMPL potentiometer R1801 slightly clockwise from the point at which SWEEP FAILURE lamp DS1801 goes out.

d. Turn TRIG COUNT-DOWN switch S1801 to position 3. The optimum switch setting is determined by target loss and overscanning of the photoconductive layer. If the countdown is too high all of the target information will not be read out of Television Camera PH-710/FSA-10, due to the large angular spacing between camera sweeps. In addition, if the countdown is too high simulated data on Azimuth and Range Indicator IP-346/FSA-10 shifts position at each revolution of the sweep. This is because the read out on a particular data pulse occurs at a different azimuth of the camera sweep on successive revolutions of the sweep. However, as the count-down is reduced a greater area of the center of the photoconductive layer is overscanned. The overscanned area is desensitized so that no target read-out occurs, resulting in a blind spot at the center of the output display. Thus the switch setting depends on obtaining a small blind spot at the center (high count-down) and a read-out of all targets on the outer area of the photoconducting layer (low count-down). A count-down higher than four should not be required. Once the equipment is aligned using the selected count-down do not change the count-down without rechecking the alignment. Further, if the repetition rate of the central radar set is changed the alignment of the television channel should be rechecked.

e. Place COUNTER TEST SELECTOR switch S1802 in position 4. Connect an Oscilloscope, OS-48 or equivalent, trigger input to test point TP1803 and probe to test point TP1806.

f. The positive portion of the wave at test point TP1806 should be 25 to 30 volts in amplitude. Set SWEEP DURATION control R1859 so that the positive portion of the waveform has a duration of 2500 microseconds for a 150-mile range or 1500 microseconds for a 100-mile range.

g. The negative portion of the waveform at test point TP1806 should have an amplitude of three to eight volts. Set AREA BALANCE DURATION control R1872 so that the negative portion of the waveform has a duration of 1700 microseconds for a 150-mile range or 1000 microseconds for a 100-mile range.

h. Connect the oscilloscope probe to test point TP1807.

i. Turn P.P.I. RANGE CALIBRATOR control R1883 and SWEEP STEP potentiometer R1882 fully counterclockwise.

j. Set SWEEP AMPL control R1880 so that the positive portion of the waveform is about 1.5 times the amplitude of the negative portion.

k. Set SWEEP STEP control R1882 for a step voltage of 0.4 volts at the start of the sweep waveform. Set P.P.I. RANGE CALIBRATOR control R1883 at its mid-range position.

l. Turn NORTH-SOUTH and EAST-WEST SWEEP TRIMMERS R1894 and R1895 fully counterclockwise.

m. Connect the oscilloscope probe to test point TP1808. The amplitude of the waveform will change as the central-radar antenna rotates. If the reference line between the positive and negative portions of the waveshape moves, adjust AREA BALANCE DURATION control R1872 until the reference line remains stationary. This adjustment is more accurate with the oscilloscope set for high sensitivity.

n. Connect the oscilloscope probe to test point TP1809. The same waveshape should be seen as at test point TP1808. Check to see that the reference line between the positive and negative portions of the waveshape remains stationary.

o. Place the center of the camera lens in line with the center of the map mask by positioning the horizontal and vertical controls on the adjustable stand of Television Camera PH-710/FSA-10 (figure 4-6). Use a square to check this position.

Note

The short sweep circuits in sweep Generator SG-131/FSA-10 are not used. Make sure tubes V1817 and V1821 are removed from their sockets and CATHODE AMPL control R1957 is in the counterclockwise position before proceeding with the alignment.

p. Refer to figure 4-8 and set COARSE ALIGNMENT control R1309 fully counterclockwise.

q. Set TARGET control R1326 for 10 volts as indicated on TARGET VOLTAGE meter M1303.

r. Turn switch S1302 to the FOCUS position and set COARSE FOCUS control R1302 for +35 milliamperes as indicated on FOCUS & ALIGNMENT CURRENT meter M1301.

s. Set FINE FOCUS control R1327 for 200 volts as indicated on FINE FOCUS VOLTAGE meter M1302.

t. Connect the oscilloscope probe to test point TP1702 on Video Amplifier AM-1356/FSA-10 (figure 4-10).

u. On Sweep Generator SG-131/FSA-10 (figure 4-8), turn UNBLANKING AMP potentiometer R1914 maximum counterclockwise.

v. On Television Camera Control C-1781/FSA-10, shown in figure 4-8, turn BIAS control R1330 slowly counterclockwise from its maximum clockwise position. At some point a scanning signal will begin to appear which will be similar to a negative sawtooth waveform. Turn BIAS control R1330 a little beyond the point where the signal disappears. On Sweep Generator SG-131/FSA-10 turn UNBLANKING AMP potentiometer R1914 clockwise until the signal reappears.

v1. Turn FINE FOCUS control R1327 counterclockwise until the waveform at test point TP1702 contains considerable noise. Leave FINE FOCUS control R1327 at a point about 10 volts above this point and most of the noise should disappear. At this point Television Camera PH-710/FSA-10 is in reasonable electrical focus. The negative signals on the waveform at test point TP1702 correspond to the map mask rings viewed by Television Camera PH-710/FSA-10. When Television Camera PH-710/FSA-10 is out of either optical or electrical focus, the negative signals are small, wide and rounded. As proper focus is reached, signal amplitude increases and becomes sharp and narrow. Adjust FINE FOCUS control R1327 to make the signals as sharp as possible. Touch up VIDEO CENTER BLANKING DURATION control R1932 and VIDEO UNBLANKING DURATION control R1940, figure 4-9, so that the video signals are blanked out at the start of the waveform enough to eliminate noise pulses and the video signals appear to the end of the waveform, respectively.

v2. Set the opening of the camera lens, shown in figure 4-6, for f2.8. Adjust the lens knurled ring in or out in steps of about $\frac{1}{8}$ turn at a time. Allow about four revolutions of the sweep of Television Camera PH-710/FSA-10 after each lens adjustment before deciding if an improvement has or has not been made. Continue this procedure until the best optical focus is obtained (sharpest signals at test point TP1702).

w. Refer to figure 4-10 and connect the oscilloscope probe to test point TP1709 on Video Amplifier AM-1356/FSA-10.

x. Set DIFFERENTIATOR switch S1701 in position 5.

y. Set REMOTE VIDEO INPUT LEVEL control R1701 to its mid-position.

z. Adjust BACKGROUND SLICER control R1718 to its mid-position.

aa. Adjust REMOTE VIDEO GAIN control R1725 until the amplitude of the peak signals is two volts.

ab. Adjust BACKGROUND SLICER control R1718 so that a pedestal at the signal base line barely appears.

ac. Turn REMOTE VIDEO INPUT LEVEL control R1701 so that only the strongest signals are being clipped.

ad. Readjust REMOTE VIDEO GAIN control R1725 so that the amplitude of the peak signals is two volts.

ae. After the preceding adjustments have been made, a map mask presentation should be present on Azimuth and Range Indicator IP-346/FSA-10. Refer to figure 4-13 and adjust VIDEO GAIN control R195, INTEN control R193 and FOCUS control R194 on Azimuth and Range Indicator IP-346/FSA-10 for the best presentation.

Note

Whenever Television Camera PH-710/FSA-10 is moved, several revolutions of the PPI sweep are required for the picture to stabilize.

af. Adjust the stand of Television Camera PH-710/FSA-10 (figure 4-6) so that the map mask display on Azimuth and Range Indicator IP-346/FSA-10 is centered. Observe the map mask range rings on Azimuth and Range Indicator IP-346/FSA-10. If the mask rings appear too far to the right, move the camera right to correct (facing the direct viewing mask) or if the mask rings appear too high, adjust the camera upward to correct. When the map mask display is centered, the map mask range rings should coincide with the Azimuth and Range Indicator IP-346/FSA-10 range rings around their entire circumference. Slight adjustments of NORTH-SOUTH R1894 and EAST-WEST R1895 SWEEP TRIMMERS, figure 4-9, will correct for non-coincidence.

Note

The map mask radials as displayed on Azimuth and Range Indicator IP-346/FSA-10 are distorted. If a line is drawn from the outer end of a map mask radial to the center of the PPI it will be noticed that the radial curves away from the line as it approaches the center of the PPI. The photoconductive layer of the camera tube is scanned in PPI fashion with the sweep rotating in synchronism with the central-radar antenna. The read-out beam, then, is a straight line of finite thickness, approximately one-quarter of an inch long, that originates at the center of the photoconductive layer. Thus, for example, if the video images on the photoconductive layer represent the north radial of a map mask, the read-out beam scans the video images near the center before it scans in the north direction. These video images will then be displayed on Azimuth and Range Indicator IP-346/FSA-10 offset from the north direction. As the read-out beam rotates it scans video images on the radial further from the center. When the outer video images are read out the beam is scanning in the north direction. The distortion is present for all radials and the azimuth error is greatest near the center. Since the remote radar sets are located beyond the range of large error the azimuth error is negligible for remote video.

ag. To align the north-south axis of the yoke of Television Camera PH-710/FSA-10, the north-south winding of resolver B1204 in Electronic Control Amplifier AM-1357/FSA-10, and the north-south axis of Azimuth and Range Indicator IP-346/FSA-10, first rotate the BEARING CURSOR, figure 4-13, on Azimuth and Range Indicator IP-346/FSA-10 to north (mechanical counters read 000 degrees).

ah. On Sweep Generator SG-131/FSA-10, figure 4-9, turn NORTH-SOUTH SWEEP TRIMMER control R1894 maximum clockwise. The map mask circles on the presentation of Azimuth and Range Indicator IP-346/FSA-10 should form an elipse indicating the north-south axis of Television Camera PH-710/FSA-10 yoke.

ai. The north-south map mask radial should coincide with the north-south axis of the yoke of Television Camera PH-710/FSA-10. Adjust resolver B1204 in Electronic Control Amplifier AM-1357/FSA-10 as follows to achieve this coincidence:

(1) Remove the front panel cover from Electronic Control Amplifier AM-1357/FSA-10 shown in figure 4-4.

(2) Loosen the three screws holding resolver B1204 housing.

(3) Remove the allen wrench from the holder on the front panel cover of Electronic Control Amplifier AM-1357/FSA-10 and insert it in the resolver zero adjustment.

(4) Rotate the resolver housing by rotating the allen wrench in the zero adjustment until the north-south map mask radial coincides with the north-south aixs of the yoke of Television Camera PH-710/FSA-10.

(5) Tighten the three screws holding the housing of resolver B1204.

(6) Replace the resolver housing adjusting wrench in its holder on the front panel cover of Electronic Control Amplifier AM-1357/FSA-10.

(7) Fasten the front panel cover in place with its four fasteners.

aj. The north-south axis of the yoke of Television Camera PH-710/FSA-10 should coincide with the north-south axis of Azimuth and Range Indicator IP-346/FSA-10. If they do not coincide adjust the camera yoke as follows:

(1) Remove the coverplate from the left side of Television Camera PH-710/FSA-10.

(2) Rotate the camera yoke L1503 until the north-south axis of the camera yoke is coincident with the cursor (000 degrees) on Azimuth and Range Indicator IP-346/FSA-10.

(3) Replace the side coverplate on Television Camera PH-710/FSA-10.

ak. Turn NORTH SOUTH SWEEP TRIMMER control R1894 on Sweep Generator SG-131/FSA-10 maximum counterclockwise.

al. (Deleted).

am. Touch up the optical focus and FINE FOCUS control R1327 (figure 4-8) until the best possible picture is shown on Azimuth and Range Indicator IP-346/FSA-10. Increase the lens opening to the maximum available aperture and touch up the optical focus.

an. To adjust the linearity of the camera sweep first make sure that the map mask pattern is centered on the display of Azimuth and Range Indicator IP-346/FSA-10. Re-position Television Camera PH-710/FSA-10 (if centering is required).

Note

For both the 100-mile and 150-mile ranges of operation, each map mask range circle represents 10 miles range. The Azimuth and Range Indicator IP-346/FSA-10 range rings appear every 10 miles for the 100-mile range and every 15 miles for the 150-mile range.

ao. At Sweep Generator SG-131/FSA-10 set P.P.I. RANGE CALIBRATOR control R1883 (figure 4-9) so that for the 100-mile range the 90-mile map mask range ring corresponds to the 90-mile range ring on Azimuth and Range Indicator IP-346/FSA-10. Match the 120-mile range rings for the 150-mile range.

ap. If the 20-mile map mask range ring (on the 100-mile range) is outside the 20-mile range ring, turn AREA BALANCE DURATION potentiometer R1872 (figure 4-9) clockwise. Use the 30-mile range rings for the 150-mile range.

aq. Adjust P.P.I. RANGE CALIBRATOR control R1883 again so that the 90-mile (or 120-mile) rings match up.

Note

If the sweep step is changed, readjust P.P.I. RANGE CALIBRATOR control R1883 and AREA BALANCE DURATION control R1872 in the manner described previously.

ar. If the 10-mile map mask circle is outside the 10-mile range ring for the 100-mile range, the camera sweep step is too great. For the 150-mile range, check the 10-mile circle with the range strobe. Reduce the sweep step in this case by adjusting SWEEP STEP potentiometer R1882. See figure 4-9.

as. Refer to figure 4-6 and illuminate map mask A by placing MASK A switch S304 in the ON position. Adjust MASK A control R301 for maximum brightness. Place MASK B switch S305 in the OFF position.

at. Line up mask A, by moving it in its support, to match the alignment of mask B as observed on Azimuth and Range Indicator IP-346/FSA-10. Mask A can be moved in north-south and east-west directions by the adjustments located on the bottom and lefthand edges of the mask, respectively.

au. The current in each alignment coil L1502, located in Television Camera PH-710/FSA-10, is adjusted by the following controls on Television Camera Control C-1781/FSA-10 shown in figure 4-8:

COARSE ALIGNMENT R1309
NO. 1 ALIGNMENT R1311
NO. 2 ALIGNMENT R1314

With switch S1302 in the NO. 1 ALIGN or NO. 2 ALIGN positions the value of current in each coil is shown on FOCUS & ALIGNMENT CURRENT meter M1301. The value of current in each coil is correct when a change of fine focus does not shift the map mask pattern center as observed on Azimuth and Range Indicator IP-346/FSA-10. These values of alignment coil current vary for different systems. Section V of the Handbook Service Instructions outlines the procedure to determine alignment coil current.

av. Initially, adjust each alignment coil current for zero indication on meter M1301. It may then be necessary to re-center Television Camera PH-710/FSA-10 each time FINE FOCUS control R1327 is changed, since the map mask center may shift.

aw. (Deleted).

ax. (Deleted).

ay. (Deleted).

az. (Deleted).

ba. Refer to figure 4-8 and set BIAS control R1330 on Television Camera Control C-1781/FSA-10 for the best focus with a minimum beam current and adequate voltage signal-to-noise ratio. BIAS VOLTAGE meter M1304 should indicate about 75 volts.

bb. Set TARGET control R1326 for the best voltage signal-to-noise ratio as observed on Azimuth and Range Indicator IP-346/FSA-10.

bc. Set DIFFERENTIATOR switch S1701 (figure 4-10) on Video Amplifier AM-1356/FSA-10 for the clearest presentation as seen on Azimuth and Range Indicator IP-346/FSA-10.

bd. Place MASK A switch S304 in the OFF position.

4-44. SMALL PPI CHANNELS, FINAL ADJUSTMENT. Final adjustment of each small PPI consists of sweep centering, adjusting sweep length and checking sweep linearity. For the following procedure, adjust the VIDEO GAIN control on the associated Indicator Control C-1780/FSA-10 for a proper PPI display only on the PPI being adjusted. Keep the presentation on all other PPI's extinguished. Proceed as follows to adjust each small PPI sweep:

a. Connect Oscilloscope OS-48 trigger to termina l4 (azimuth change pulse input) on fanning strip E910 of Sweep Generator SG-132/FSA-10, figure 4-5.

b. Connect the oscilloscope probe to NORTH-SOUTH SWEEP test point TP908 located on the front panel of Sweep Generator SG-132/FSA-10.

c. Stop the resolver B702 in the associated Electrical Synchronizer SN-166/FSA-10 by placing MOTOR switch S703 in the OFF position when the sweep voltage is at maximum amplitude.

d. Note that at the end of the rising portion of the sweep waveform that there is a gradual negative-going portion before the waveform drops abruptly. Adjust RESOLVER DRIVER BALANCE control R941 so that the sweep length is slightly longer than 40 milliseconds (about 41 milliseconds) from the start of the sawtooth rise to the point where the waveform starts its negative excursion.

e. Connect the oscilloscope probe to EAST-WEST SWEEP test point TP906 and perform steps c and d.

f. Perform the preceding steps for all operating small PPI channels.

g. Disconnect the oscilloscope test leads and place MOTOR switch S703 on Electrical Synchronizer SN-166/FSA-10 in the ON position.

h. Observe that the small PPI sweeps appear stable without any jitter.

i. Position one of the small PPI's in cluster B, through its positioning controls, so that its center coincides with the central-radar center as observed on Azimuth and Range Indicator IP-346/FSA-10.

Note

The pattern dots on the small PPI's curve from the center of the PPI tube to the outer edge. This is because the small PPI sweep rotates 1.4 degrees for each sweep.

j. A blind spot will appear at the center of the dis. play on Azimuth and Range Indicator IP-346/FSA-10. Set FINE FOCUS control R1327 and BIAS control R1330 on Television Camera Control C-1781/FSA-10 (figure 4-8) for the minimum diameter of this blind area consistent with good signal-to-noise ratio. A blind spot 10 miles in diameter is the maximum desired for the 100-mile range and 15 miles in diameter for the 150-mile range.

k. Center the small PPI sweep by adjusting the NORTH SOUTH CENTER and EAST WEST CENTER controls on the associated Indicator Control C-1780/FSA-10 (figure 4-7).

l. Select a RANGE STROBE of 48.0 miles on Azimuth and Range Indicator IP-346/FSA-10. For the 150-mile range the strobe range indication will be 32.0 for a 48.0-mile strobe. Adjust STROBE GAIN control R191, figure 4-13, for the desired strobe intensity.

m. Adjust the NORTH SOUTH CENTER, EAST WEST CENTER, NORTH SOUTH AMPLITUDE and EAST WEST AMPLITUDE controls on the associated Indicated Control C-1780/FSA-10 and the small PPI positioning controls until the cross pattern is centered on the small PPI tube. The 48-mile range mark (eighth dot) on each arm of the cross (90° angle marks) should be coincident with the 48.0 mile RANGE STROBE on Azimuth and Range Indicator IP-346/FSA-10.

n. Select a RANGE STROBE of 12.0 miles (or 18.0 miles if the 12-mile range mark is not shown for the 150-mile range on Azimuth and Range Indicator IP-346/FSA-10). For the 150-mile range the strobe range indication will be 12.0 for an 18.0-mile strobe. The 12-mile range mark (second dot) on each 90° angle mark should be coincident with the 12.0-mile range strobe. Readjust controls set in step m if necessary to obtain this coincidence.

o. Select a RANGE STROBE of 30.0 miles. For the 150-mile range the strobe range indication will be 20.0 for a 30.0-mile strobe. The 30-mile range mark (fifth dot) on each 90° angle mark should be coincident with the 30.0-mile range strobe. Readjust controls set in step m if necessary to obtain this coincidence. SWEEP LINEARITY control R1027 and RETRACE PERIOD ADJUST control R905 on Sweep Generator SG-132/FSA-10, shown in figure 4-5, may require slight adjustment to obtain final coincidence in steps m, n and o. RETRACE PERIOD ADJUST control R905 will affect coincidence at the 12-mile range. The duration of the retrace period waveform must not be less than 1250 microseconds.

p. The procedure in steps i through p calibrates the size of the presentation on a small PPI. Repeat this procedure for all operating small PPI's.

4-45. ORIENTATION OF THE SMALL PPI DISPLAY TUBES. The last adjustment concerns orienting the small PPI display tubes so that their positions correspond to the geographic locations of the associated remote radar sets. In addition, the north marks shown on each small PPI must be oriented along the true north axis. The direction of rotation of the directly viewed PPI's should correspond to the direction of rotation of the associated remote-radar antennas. The sweeps of the reflected PPI displays should rotate when viewed by the observer, in the direction opposite to the direction of motion of the associated remote-radar antennas. This inversion is a consequence of reflection. SWEEP ROTATION DIRECTION switch S901 in Sweep Generator SG-132/FSA-10 (figure 4-5) determines the direction of rotation of the small PPI sweep. The small PPI tubes correspond to the channels as follows:

V1506	Channel 1A
V1508	Channel 1B
V1505	Channel 2A
V1509	Channel 2B
V1507	Channel 3A
V1510	Channel 3B

Figure 11-11. Electri

b. Connect the oscilloscope probe to NORTH-SOUTH SWEEP test point TP908 located on the front panel of Sweep Generator SG-132/FSA-10.

c. Stop the resolver B702 in the associated Electrical Synchronizer SN-166/FSA-10 by placing MOTOR switch S703 in the OFF position when the sweep voltage is at maximum amplitude.

d. Note that at the end of the rising portion of the sweep waveform that there is a gradual negative-going portion before the waveform drops abruptly. Adjust RESOLVER DRIVER BALANCE control R941 so that the sweep length is slightly longer than 40 milliseconds (about 41 milliseconds) from the start of the sawtooth rise to the point where the waveform starts its negative excursion.

e. Connect the oscilloscope probe to EAST-WEST SWEEP test point TP906 and perform steps c and d.

f. Perform the preceding steps for all operating small PPI channels.

g. Disconnect the oscilloscope test leads and place MOTOR switch S703 on Electrical Synchronizer SN-166/FSA-10 in the ON position.

h. Observe that the small PPI sweeps appear stable without any jitter.

i. Position one of the small PPI's in cluster B, through its positioning controls, so that its center coincides with the central-radar center as observed on Azimuth and Range Indicator IP-346/FSA-10.

Note

The pattern dots on the small PPI's curve from the center of the PPI tube to the outer edge. This is because the small PPI sweep rotates 1.4 degrees for each sweep.

j. A blind spot will appear at the center of the dis. play on Azimuth and Range Indicator IP-346/FSA-10. Set FINE FOCUS control R1327 and BIAS control R1330 on Television Camera Control C-1781/FSA-10 (figure 4-8) for the minimum diameter of this blind area consistent with good signal-to-noise ratio. A blind spot 10 miles in diameter is the maximum desired for the 100-mile range and 15 miles in diameter for the 150-mile range.

k. Center the small PPI sweep by adjusting the NORTH SOUTH CENTER and EAST WEST CENTER controls on the associated Indicator Control C-1780/FSA-10 (figure 4-7).

l. Select a RANGE STROBE of 48.0 miles on Azimuth and Range Indicator IP-346/FSA-10. For the 150-mile range the strobe range indication will be 32.0 for a 48.0-mile strobe. Adjust STROBE GAIN control R191, figure 4-13, for the desired strobe intensity.

m. Adjust the NORTH SOUTH CENTER, EAST WEST CENTER, NORTH SOUTH AMPLITUDE and EAST WEST AMPLITUDE controls on the associated Indicated Control C-1780/FSA-10 and the small PPI positioning controls until the cross pattern is centered on the small PPI tube. The 48-mile range mark (eighth dot) on each arm of the cross (90° angle marks) should be coincident with the 48.0 mile RANGE STROBE on Azimuth and Range Indicator IP-346/FSA-10.

n. Select a RANGE STROBE of 12.0 miles (or 18.0 miles if the 12-mile range mark is not shown for the 150-mile range on Azimuth and Range Indicator IP-346/FSA-10). For the 150-mile range the strobe range indication will be 12.0 for an 18.0-mile strobe. The 12-mile range mark (second dot) on each 90° angle mark should be coincident with the 12.0-mile range strobe. Readjust controls set in step m if necessary to obtain this coincidence.

o. Select a RANGE STROBE of 30.0 miles. For the 150-mile range the strobe range indication will be 20.0 for a 30.0-mile strobe. The 30-mile range mark (fifth dot) on each 90° angle mark should be coincident with the 30.0-mile range strobe. Readjust controls set in step m if necessary to obtain this coincidence. SWEEP LINEARITY control R1027 and RETRACE PERIOD ADJUST control R905 on Sweep Generator SG-132/FSA-10, shown in figure 4-5, may require slight adjustment to obtain final coincidence in steps m, n and o. RETRACE PERIOD ADJUST control R905 will affect coincidence at the 12-mile range. The duration of the retrace period waveform must not be less than 1250 microseconds.

p. The procedure in steps i through p calibrates the size of the presentation on a small PPI. Repeat this procedure for all operating small PPI's.

4-45. ORIENTATION OF THE SMALL PPI DISPLAY TUBES. The last adjustment concerns orienting the small PPI display tubes so that their positions correspond to the geographic locations of the associated remote radar sets. In addition, the north marks shown on each small PPI must be oriented along the true north axis. The direction of rotation of the directly viewed PPI's should correspond to the direction of rotation of the associated remote-radar antennas. The sweeps of the reflected PPI displays should rotate when viewed by the observer, in the direction opposite to the direction of motion of the associated remote-radar antennas. This inversion is a consequence of reflection. SWEEP ROTATION DIRECTION switch S901 in Sweep Generator SG-132/FSA-10 (figure 4-5) determines the direction of rotation of the small PPI sweep. The small PPI tubes correspond to the channels as follows:

V1506	Channel 1A
V1508	Channel 1B
V1505	Channel 2A
V1509	Channel 2B
V1507	Channel 3A
V1510	Channel 3B

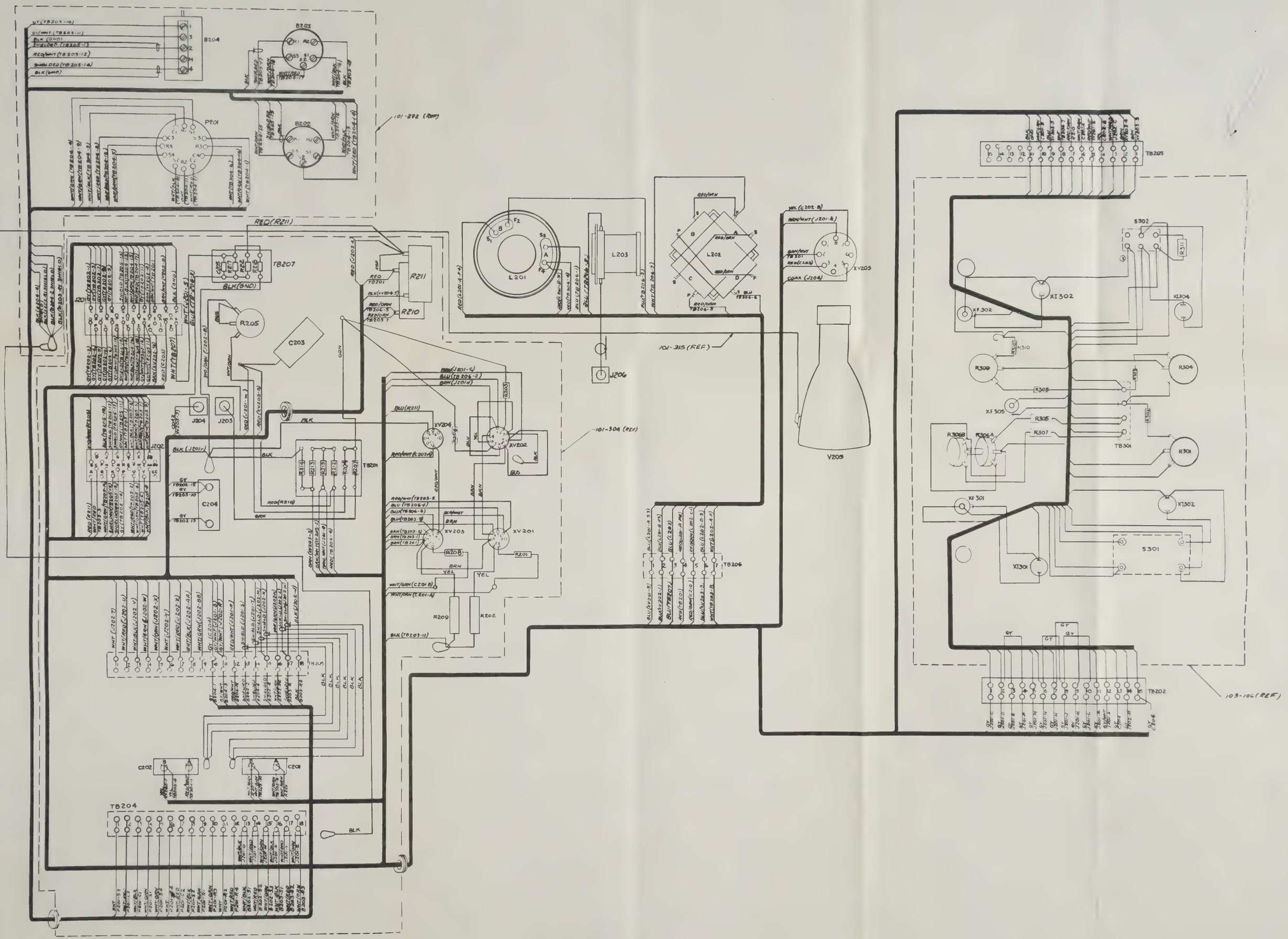


Figure 11-11. Electrical Synchronizer Wiring Diagram

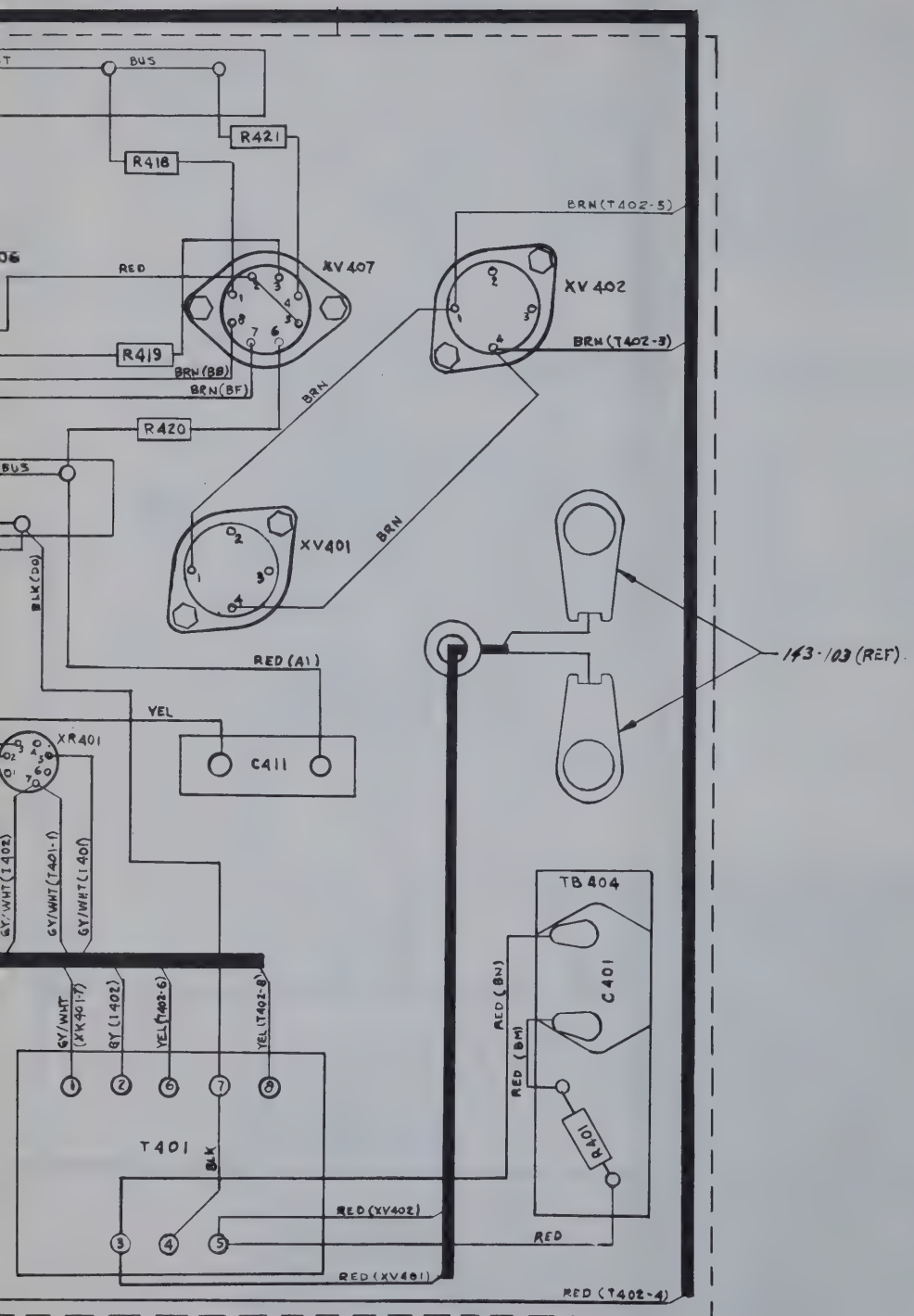
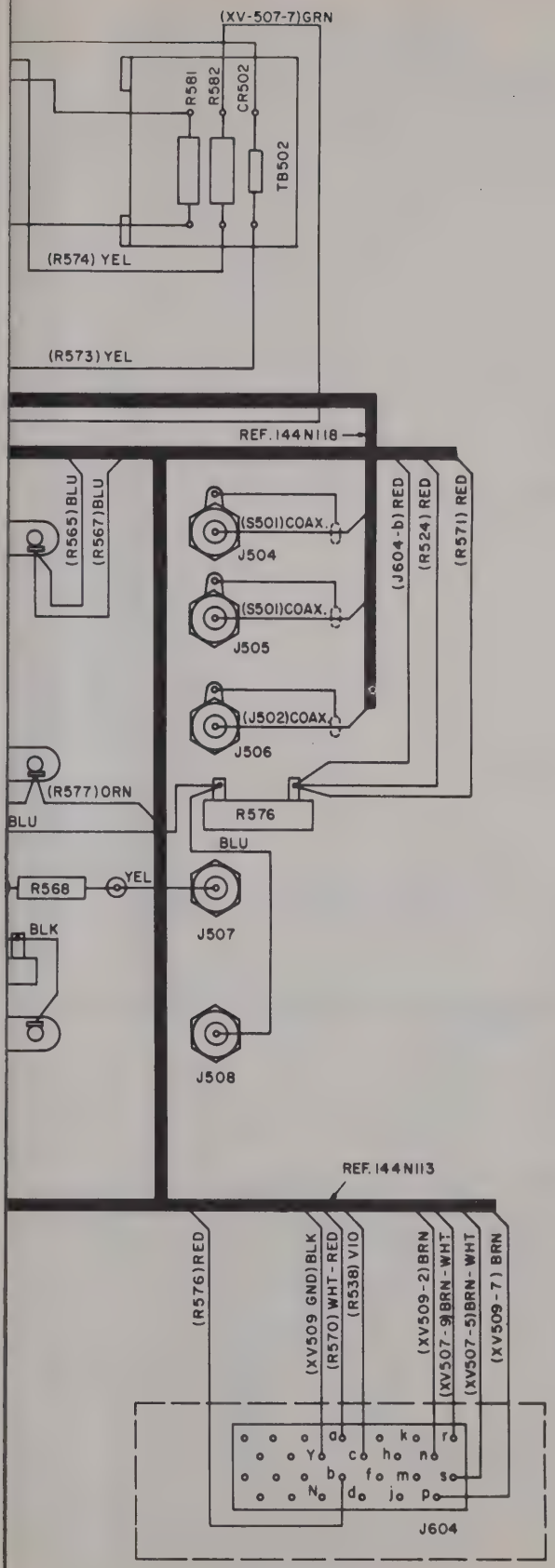


Figure 11-12. Power Supply Wiring Diagram


(XV-507-7)GRN
R581
R582
CR502
TB502
(R574) YEL
(R573) YEL
REF. 144N118
(R565) BLU
(R567) BLU
(S501) COAX.
J504
(S501) COAX.
J505
(J502) COAX.
J506
(J604-b) RED
(R524) RED
(R571) RED
(R577) ORN
BLU
R576
BLU
R568
YEL
BLK
J507
J508
REF. 144N113
(R576) RED
(XV509 GND) BLK
(R570) WHT-RED
(R538) VIO
(XV509-2) BRN
(XV507-9) BRN-WHT
(XV507-5) BRN-WHT
(XV509-7) BRN
J604

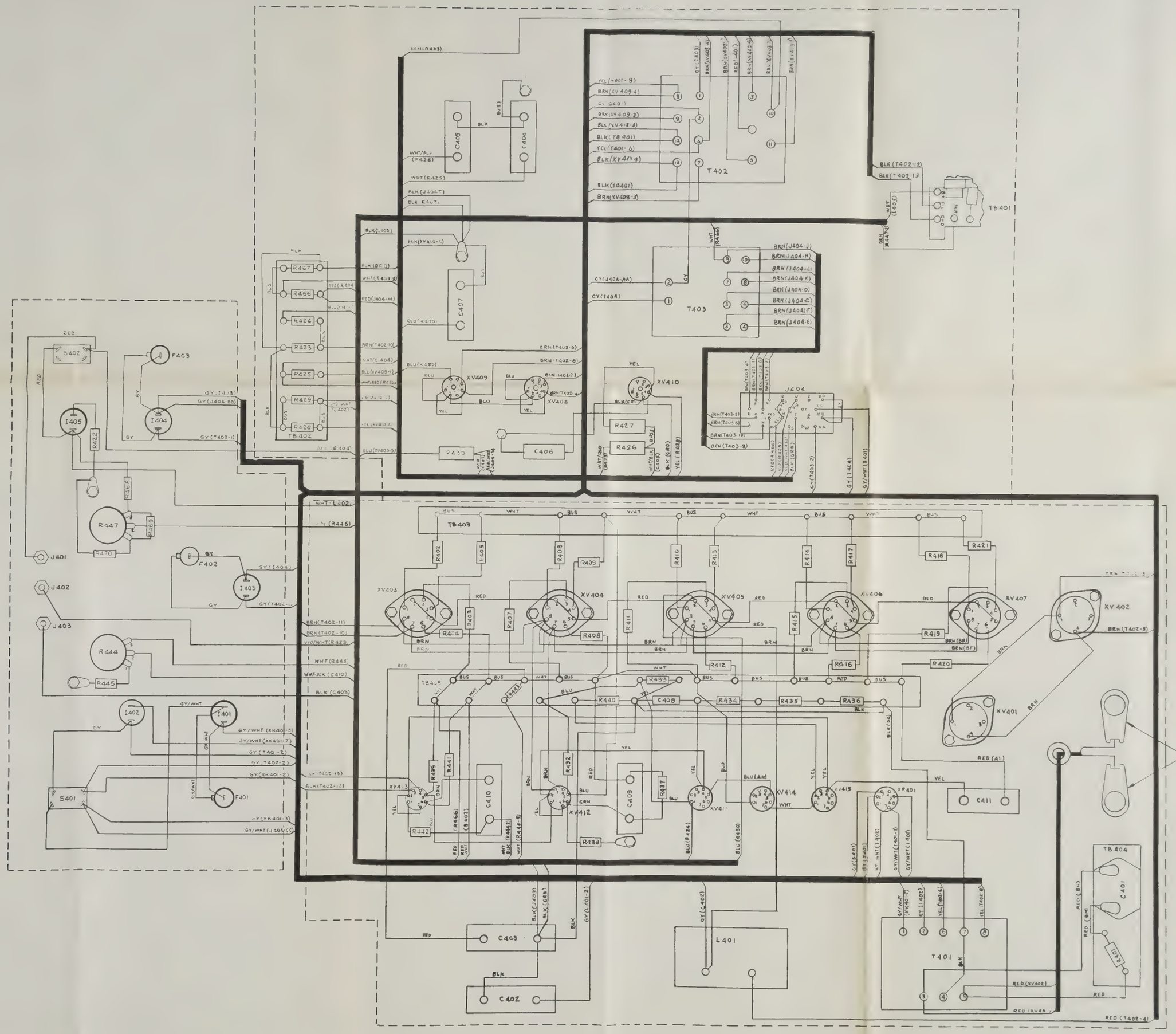


Figure 11-12. Power Supply Wiring Diagram

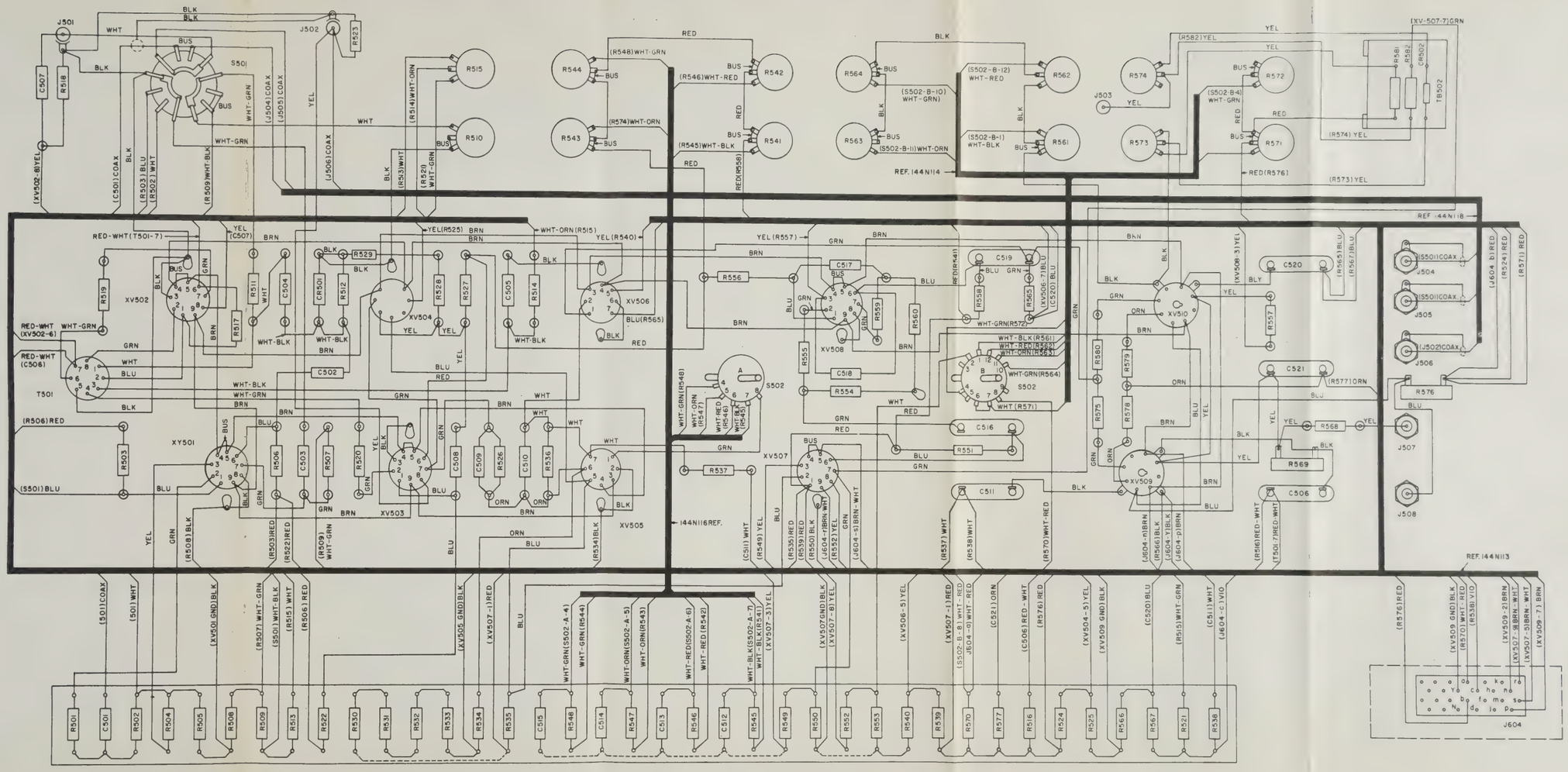
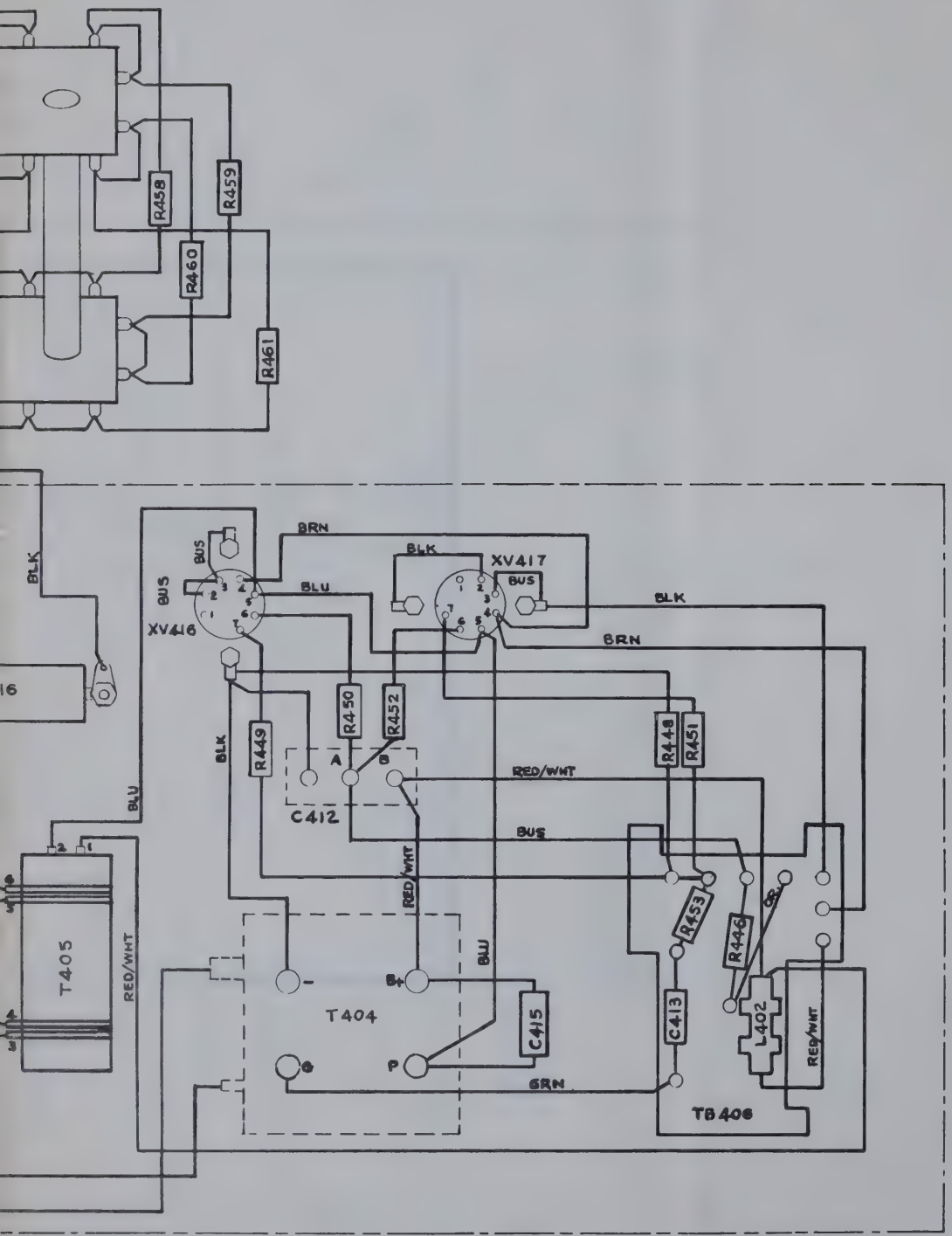


Figure 11-13. Sweep Generator Wiring Diagram



11-15. High Voltage Power Supply Wiring Diagram

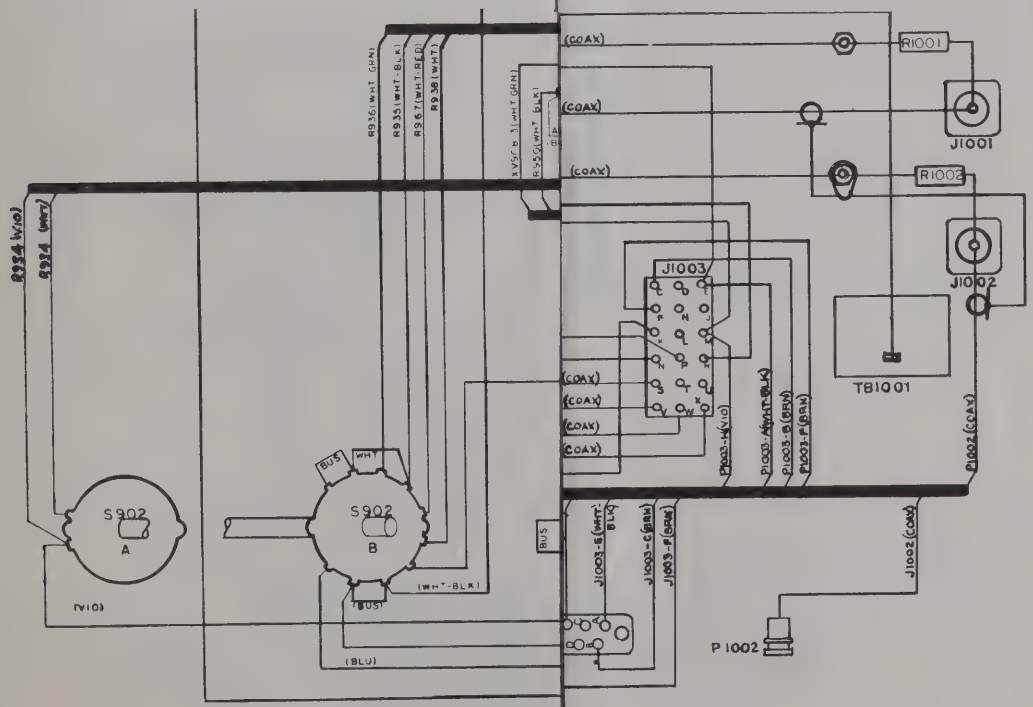


Figure 11-16. Os

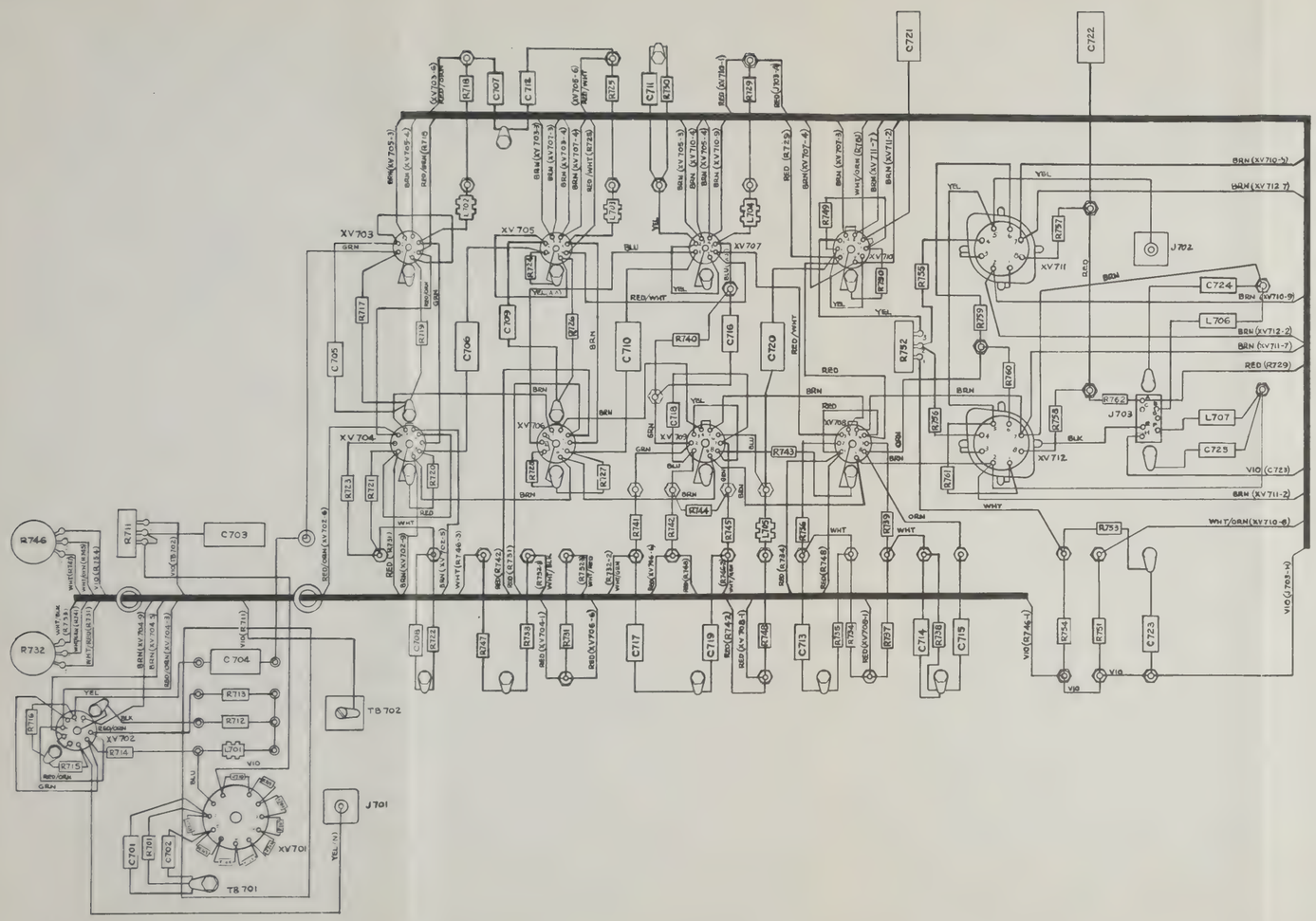


Figure 11-14. Video Amplifier Wiring Diagram

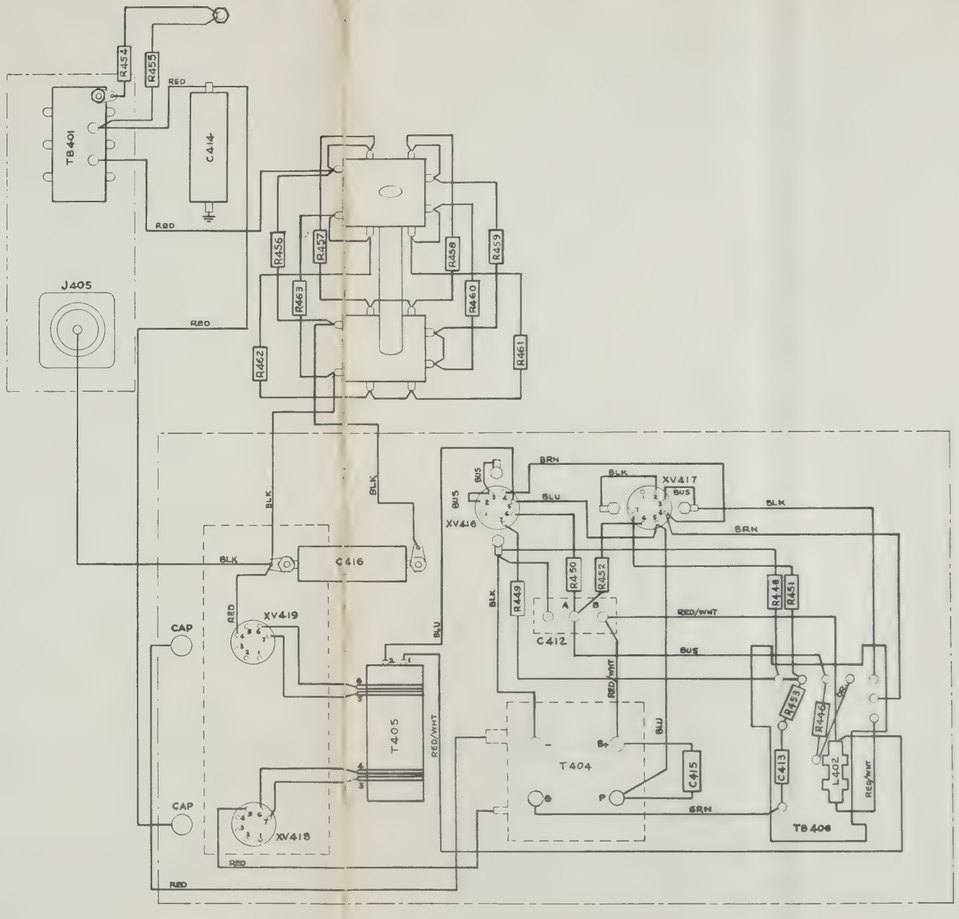
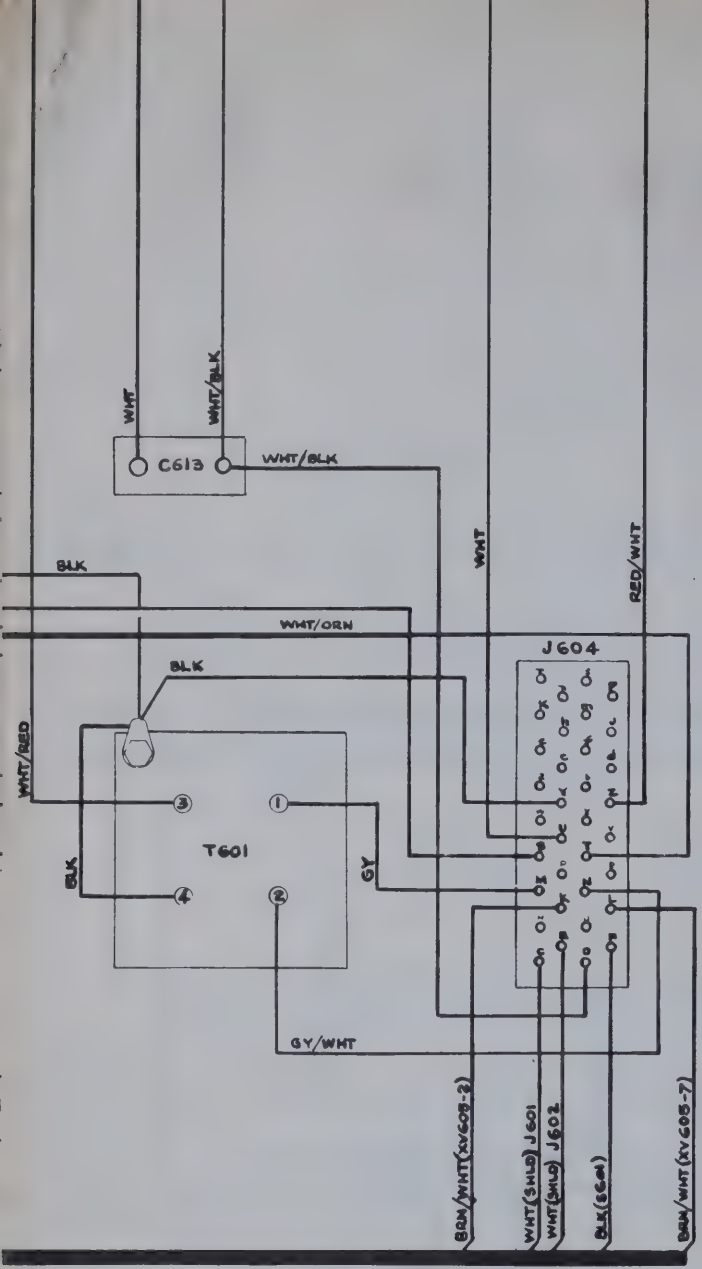


Figure 11-15. High Voltage Power Supply Wiring Diagram

Figure 11-16. Oscilloscope Wiring Diagram



Electronic Control Amplifier Wiring Diagram

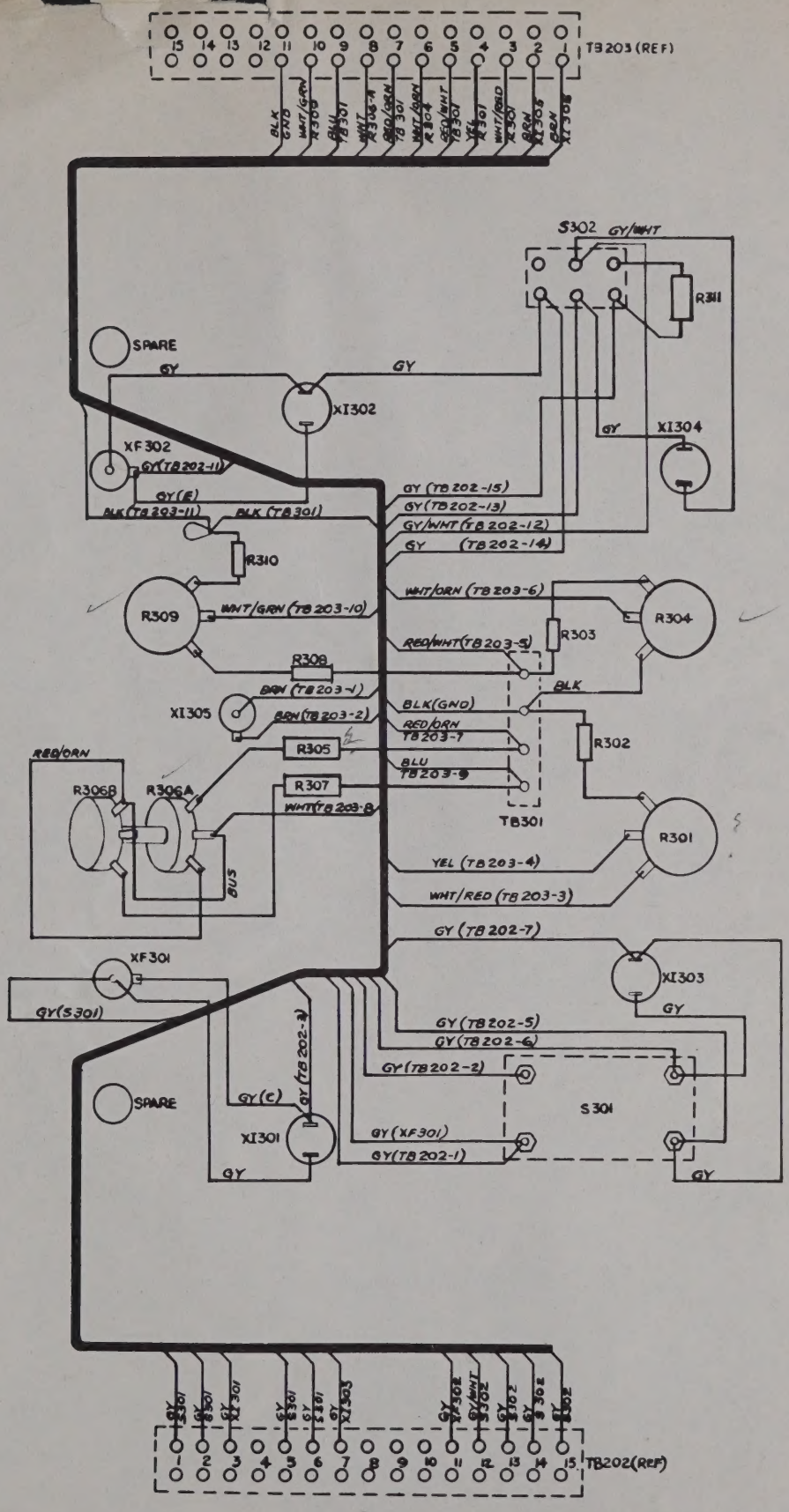


Figure 11-18. Power Distribution Panel Wiring Diagram

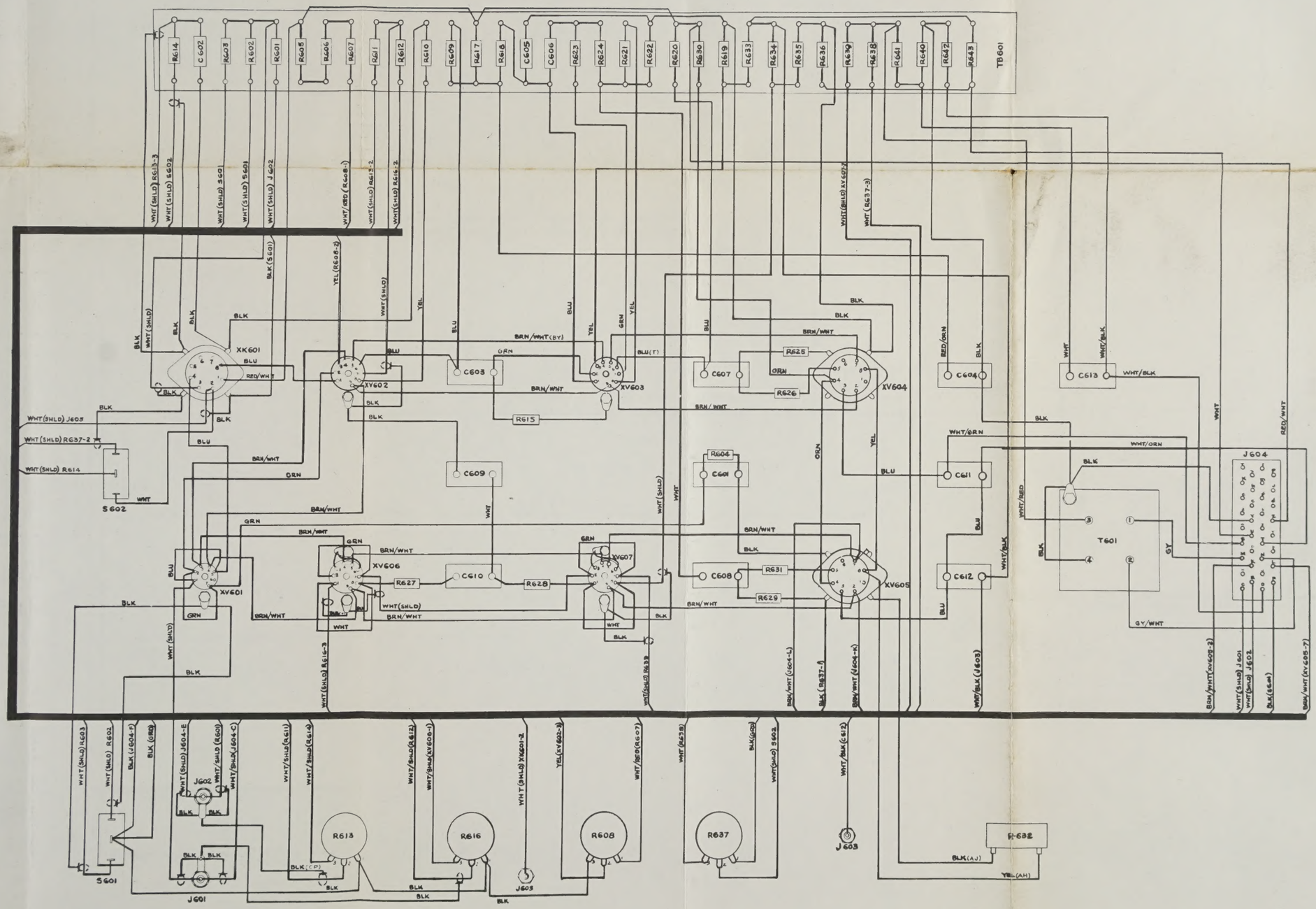


Figure 11-17. Electronic Control Amplifier Wiring Diagram

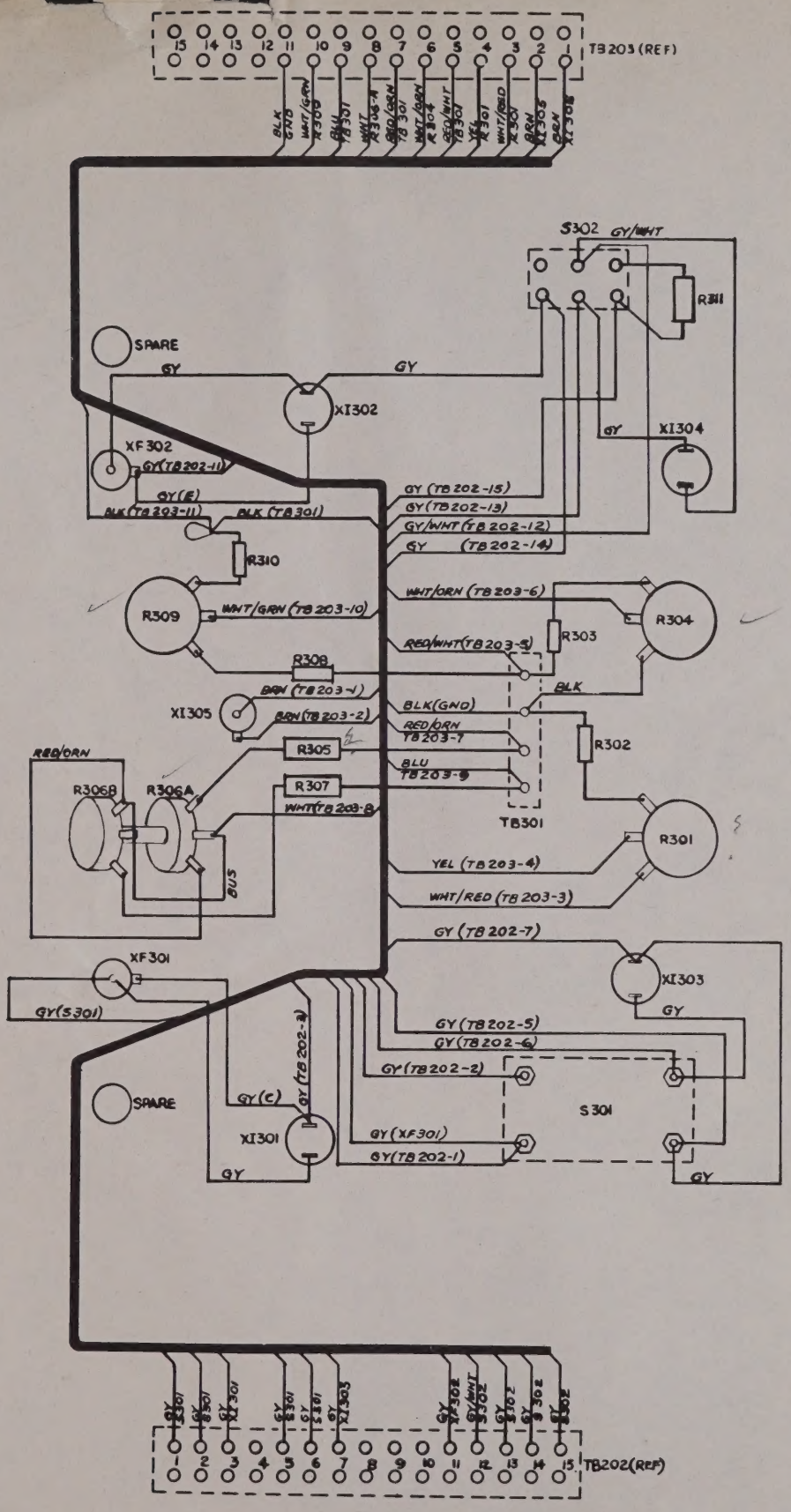


Figure 11-18. Power Distribution Panel Wiring Diagram